U.S. Army Corps of Engineers Readiness Support Center

SSA PRT Training

POST DISASTER SAFETY EVALUATION of BUILDINGS

- **PART I - Loads, Materials, & Basic Structural Systems**

- **PART II - Procedures For Post Disaster Safety Evaluation Of Buildings (ATC-20)**

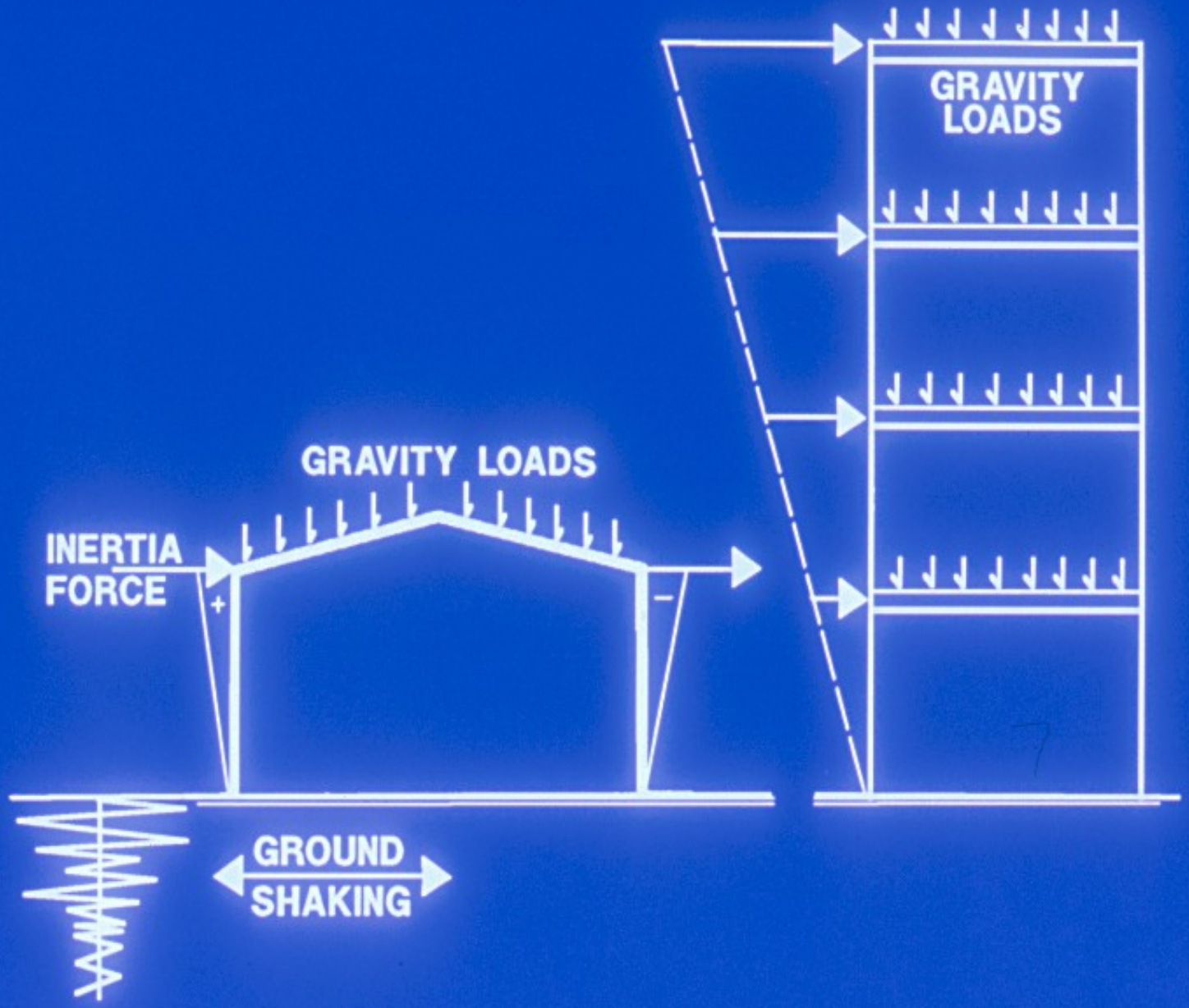
SSA PRT Training

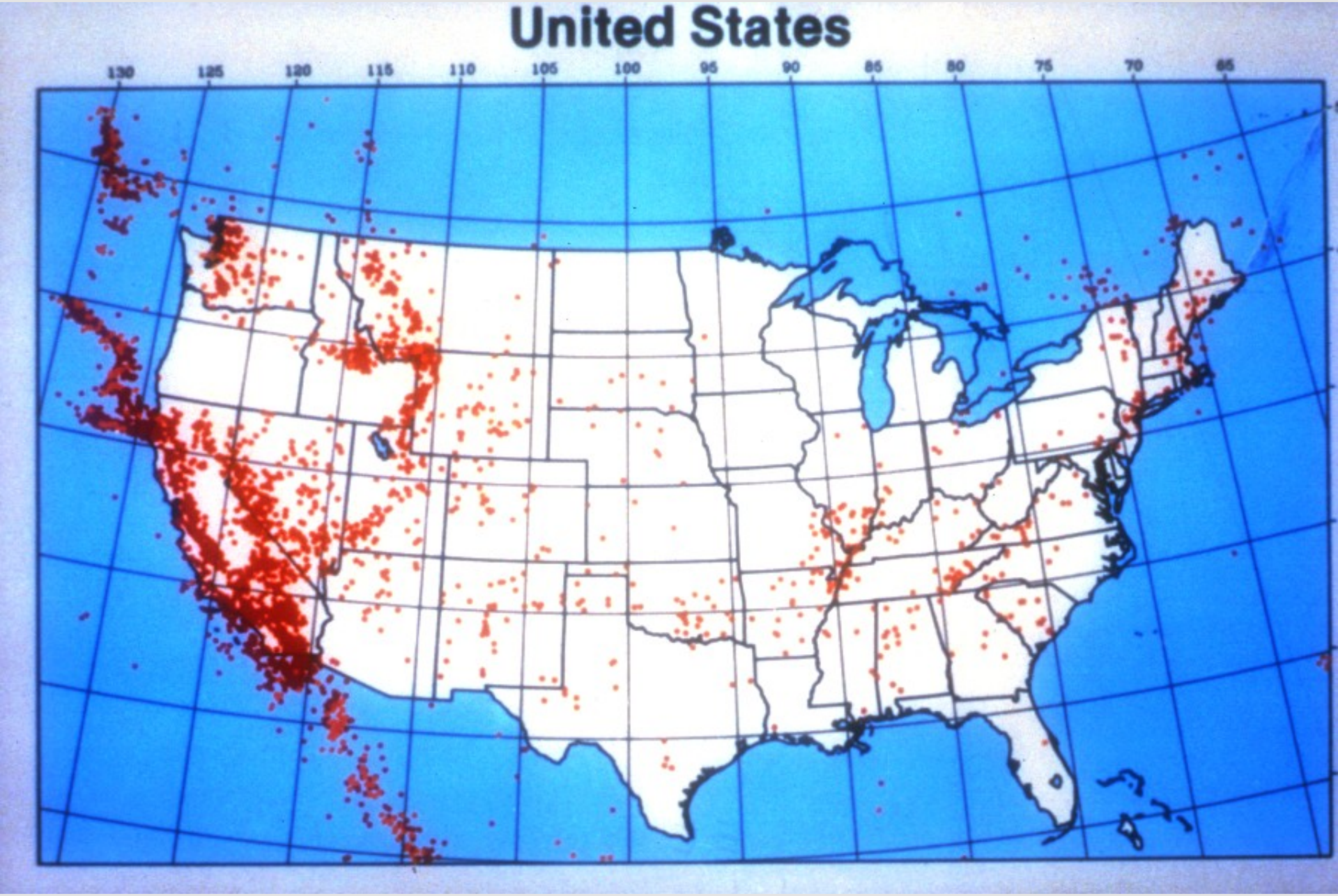
PART I

LOADS, MATERIALS, BASIC STRUCTURAL SYSTEMS

TOPICS to be Discussed

- Earthquakes
- Wind
- Floods
- Force Types
- Ductile vs Brittle
- Material Behavior
- Vertical Load Systems
- Lateral Load Resistant Systems
- Redundancy
- Collapse Patterns


GRAVITY LOADS
GRAVITY LOADS
INERTIA FORCE
+
−
GROUND SHAKING


United States
130
125
120
115
110
105
100
95
90
85
80
75
70
65

RICHTER SCALE

Richter Magnitude	4	➡	6	➡	8
Energy Increase		1000		1000	

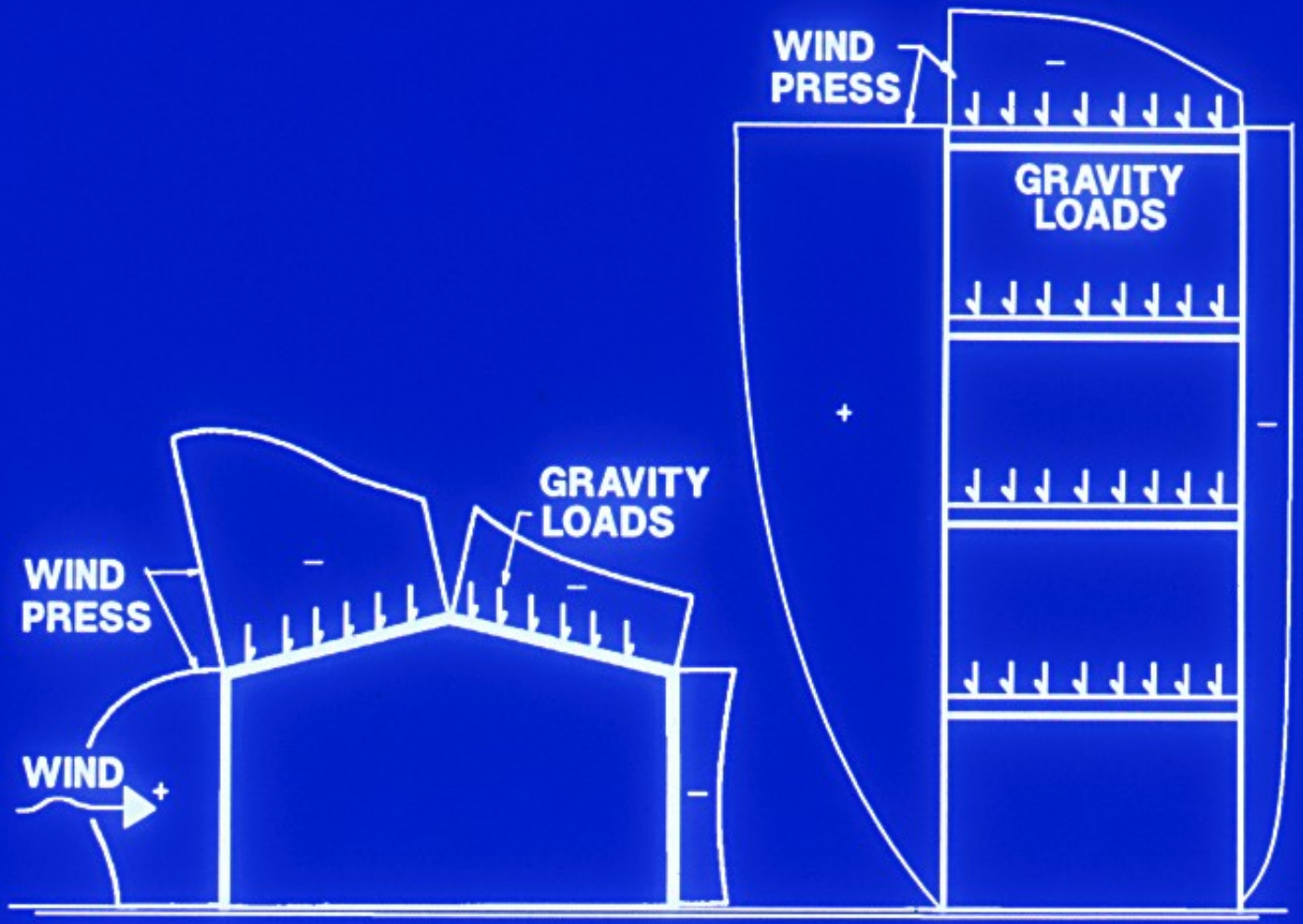
MODIFIED MERCALLI INTENSITY SCALE

MMI VI - Windows broken. Books off shelves. Weak plaster cracked.

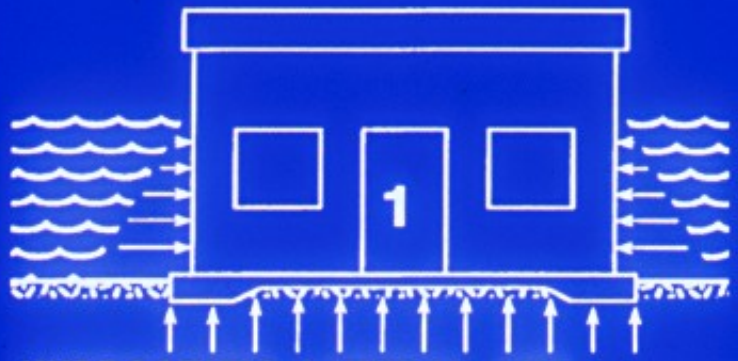
MMI VII - Damage to weakest masonry. Weak chimneys broken. Fall of plaster, loose bricks, tiles, unbraced parapets.

MMI VIII - Damage to weak masonry, partial collapse. Frame houses moved on foundations.

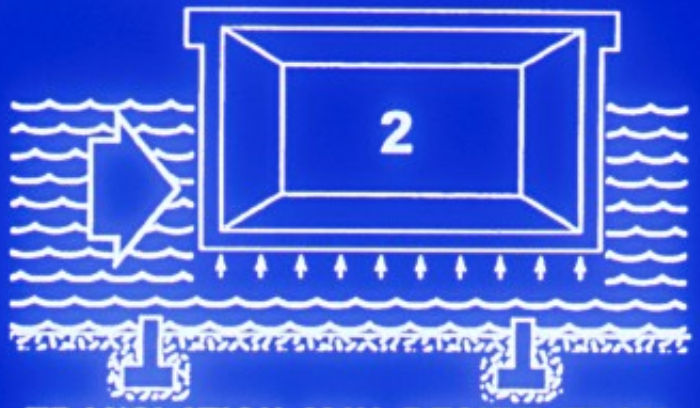
1132


WIND
PRESS
GRAVITY
LOADS
WIND
PRESS
GRAVITY
LOADS
WIND

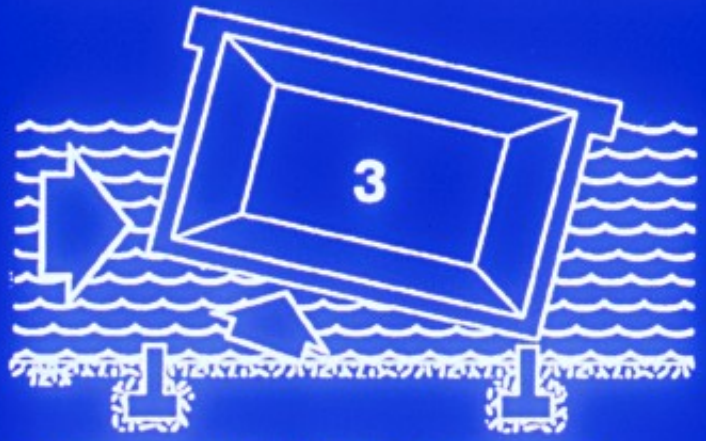
BASIC LOADING PATTERNS • FLOOD



HYDROSTATIC LATERAL AND UPLIFT PRESSURES PERPENDICULAR TO ALL SURFACES OF EMPTY BLDG



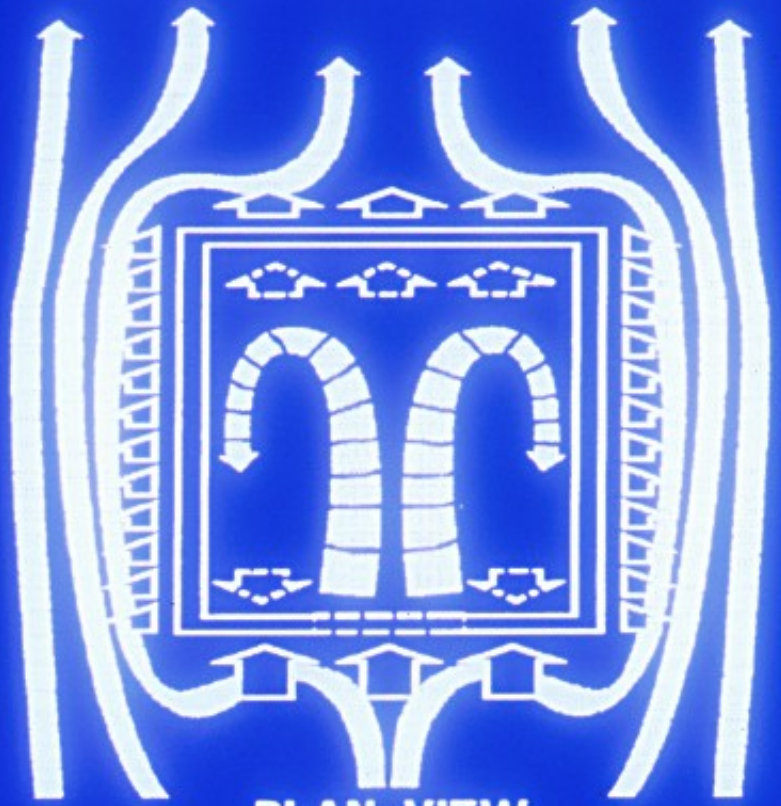
TRANSLATION MAY RESULT FROM COMBINATION OF BUOYANCY AND HYDRODYNAMIC FORCES



OVERTURNING MAY OCCUR IF FRICTION, CONNECTIONS, UNEVEN WATER INFILTRATION HOLDS ONE EDGE OF BLDG TO FOUNDATION

EVEN WHEN STRUCTURES ARE NOT MOVED, RUSHING WATER CAN CAUSE SCOUR & EROSION AROUND SLABS & FOUNDATIONS

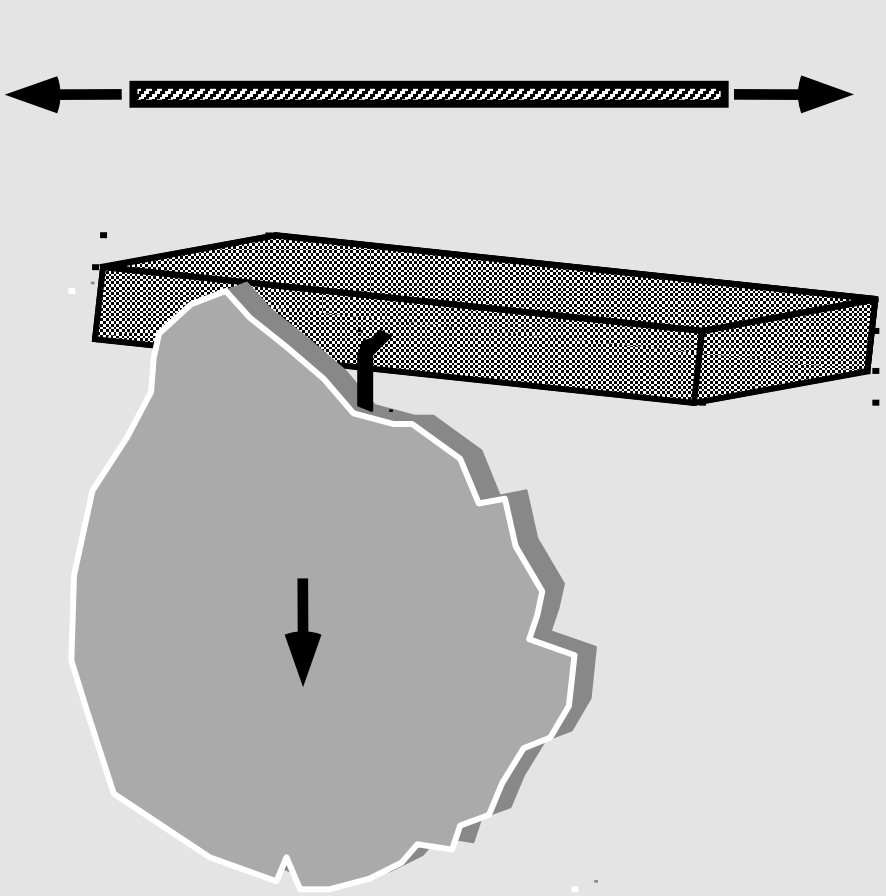
BASIC LOADING PATTERNS • FLOOD

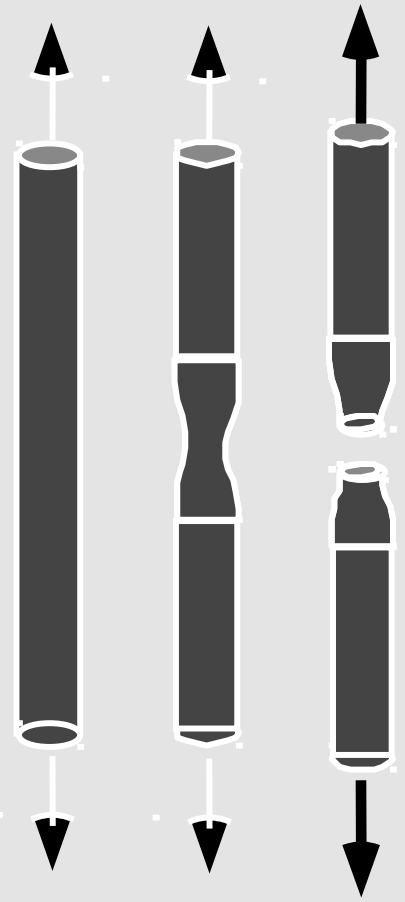


PLAN VIEW

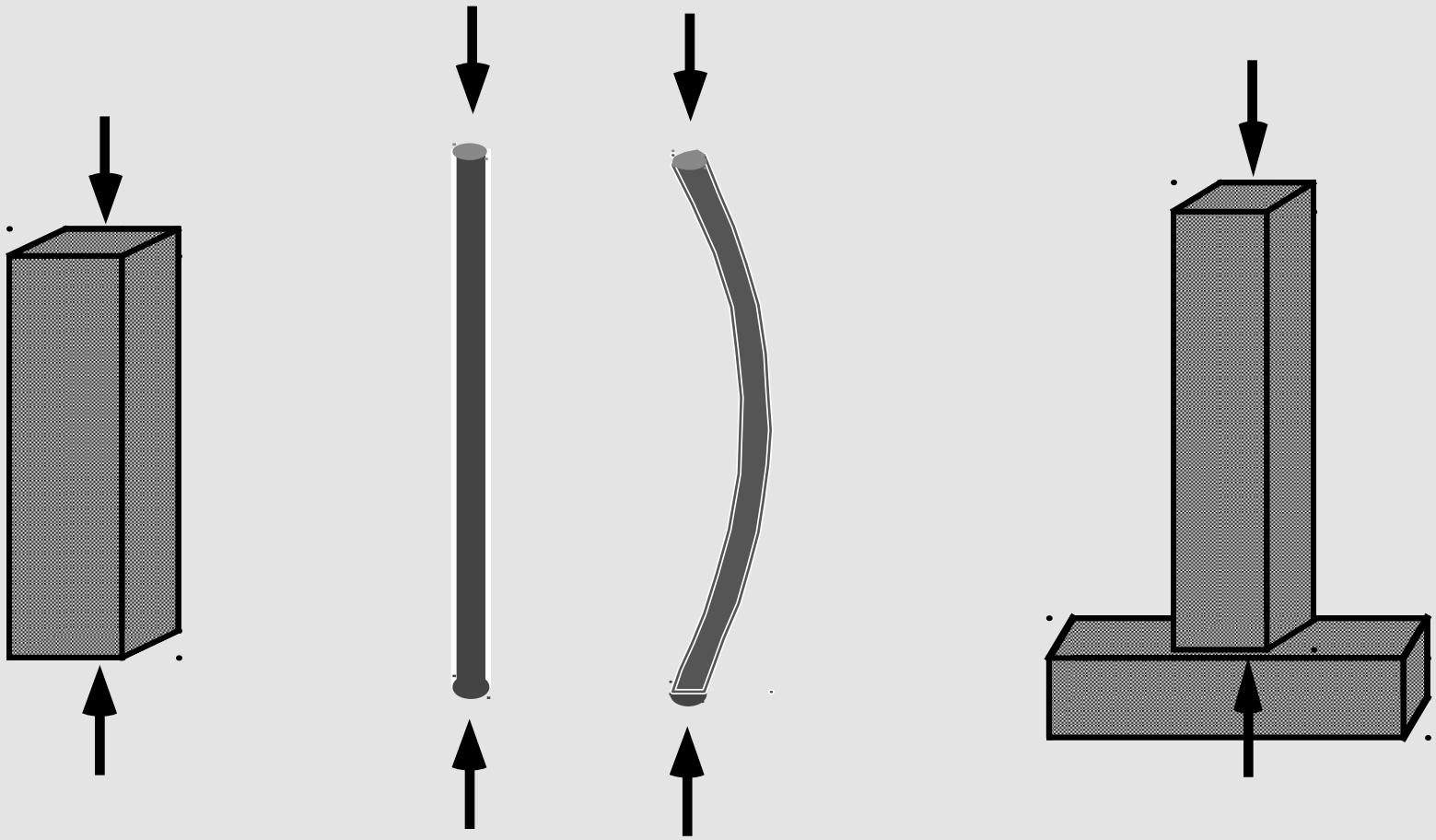
HYDRODYNAMIC FORCES INCLUDE THE IMPACT OF WATER & WAVES ON THE UPSTREAM SIDE, DRAG FORCES ON SIDES, & SUCTION PRESSURE ON TO DOWNSTREAM SIDE. WHEN WATER RUSHES INTO A STRUCTURE (shown dashed) IT IMPACTS THE FACING WALL AND THEN TURNS BACK TOWARDS ITS POINT OF ORIGIN, CAUSING HYDRODYNAMIC FORCES ON INTERIOR ELEMENTS.

Force Type: Tension

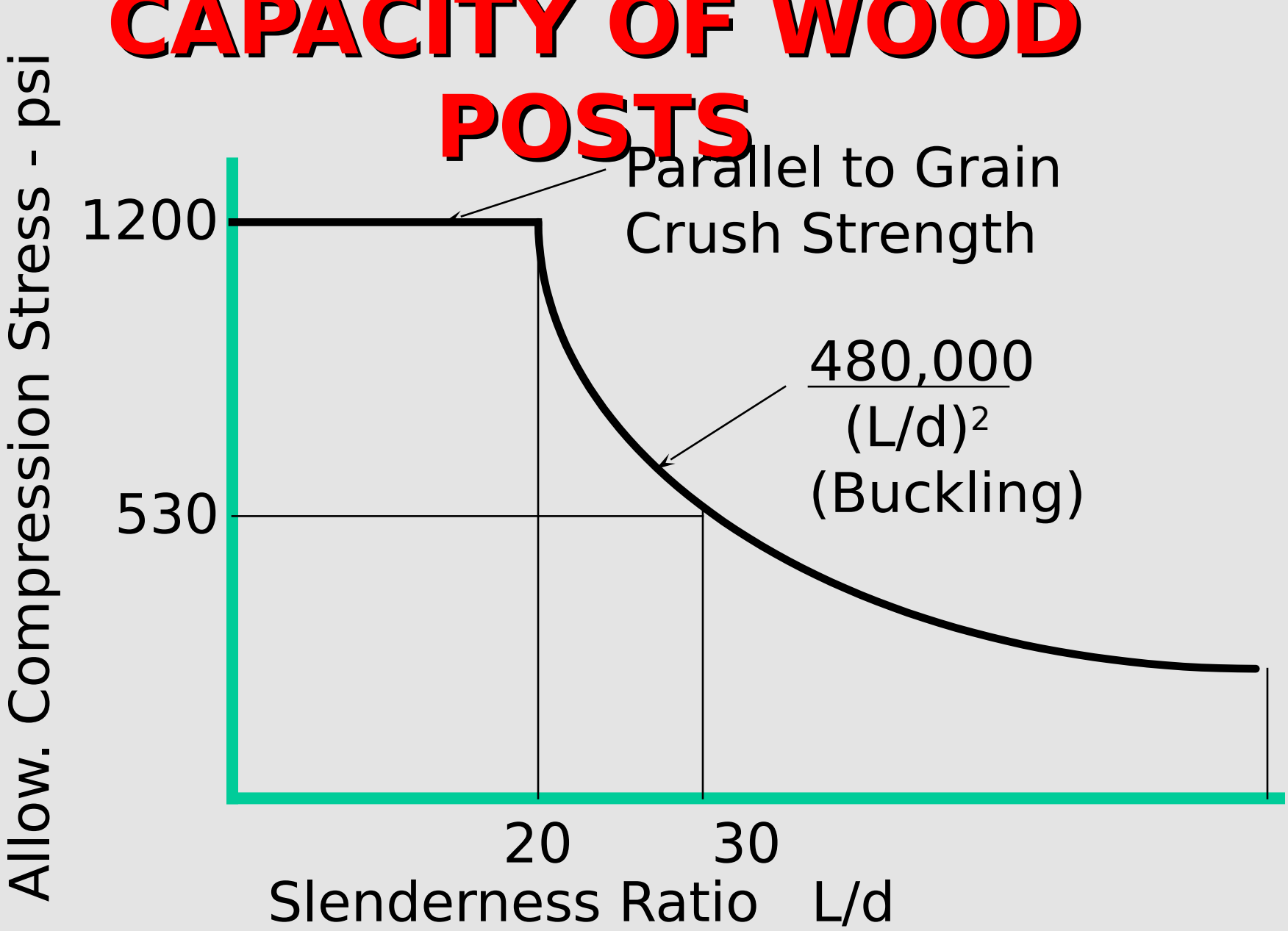




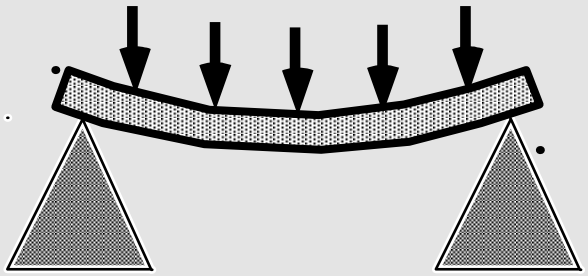
Force Type: Compression

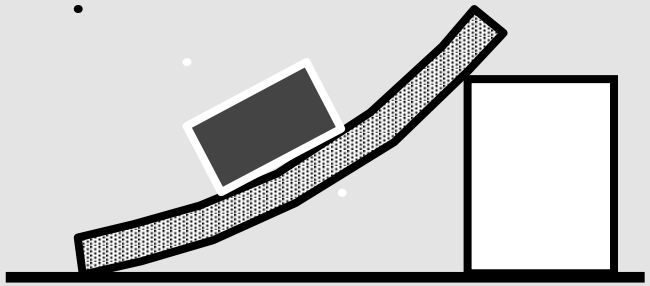


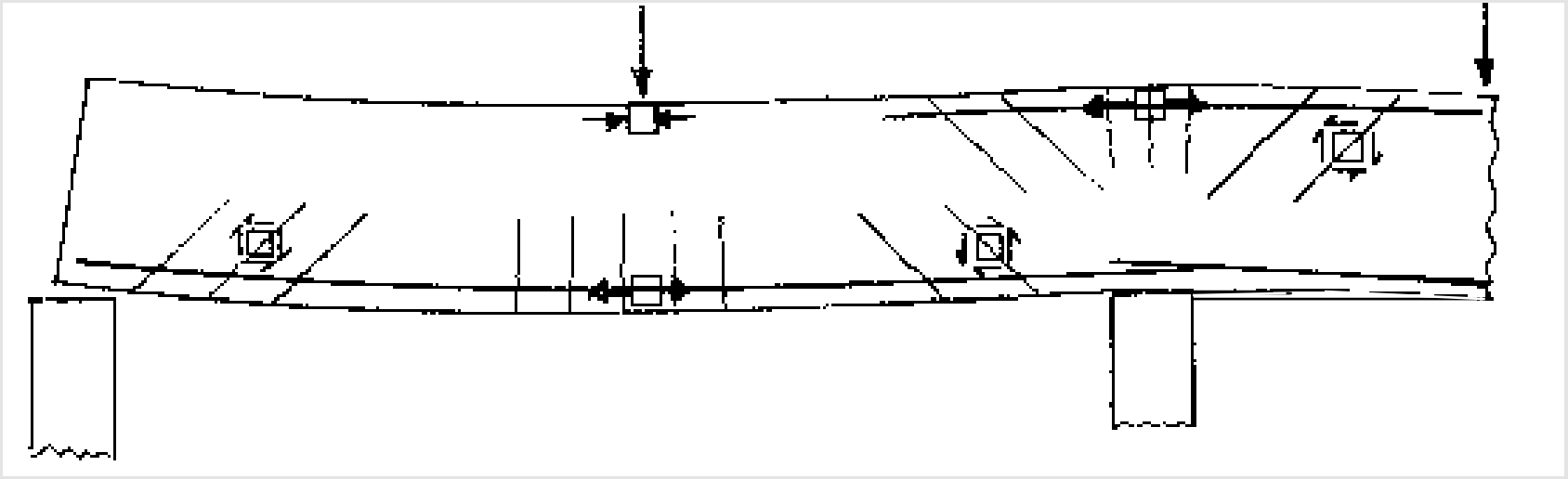
CAPACITY OF WOOD POSTS



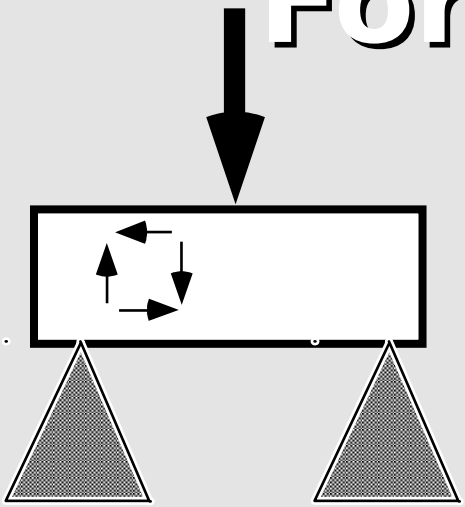
Force Type: Bending

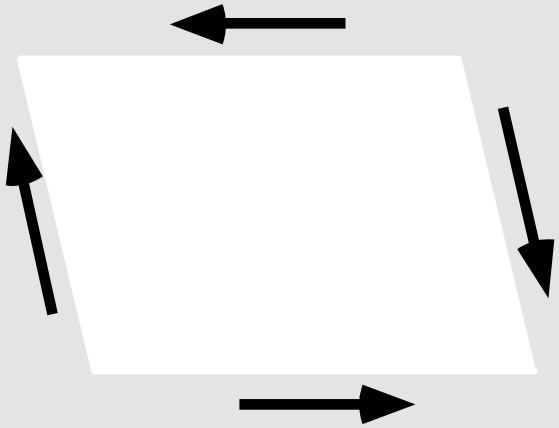


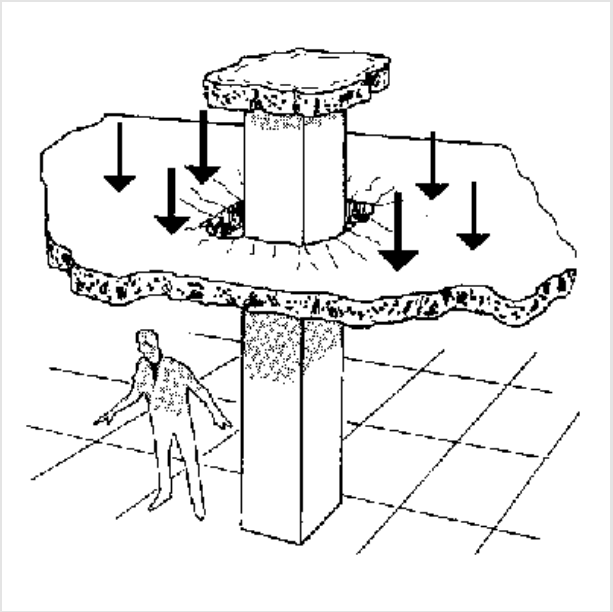


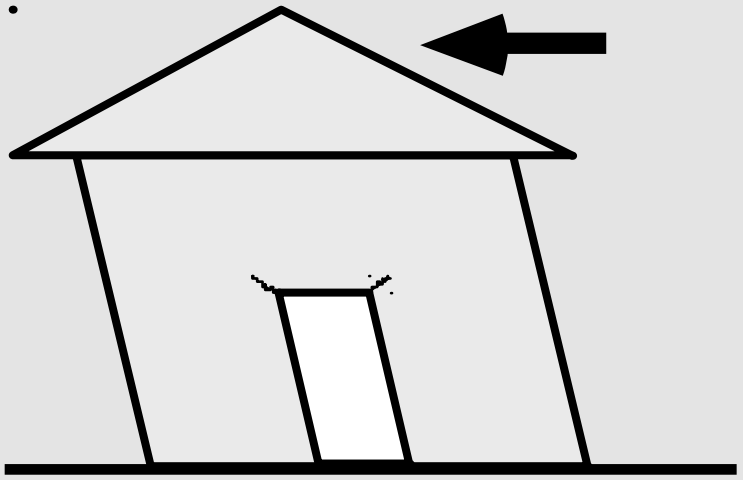


Force Type: Shear





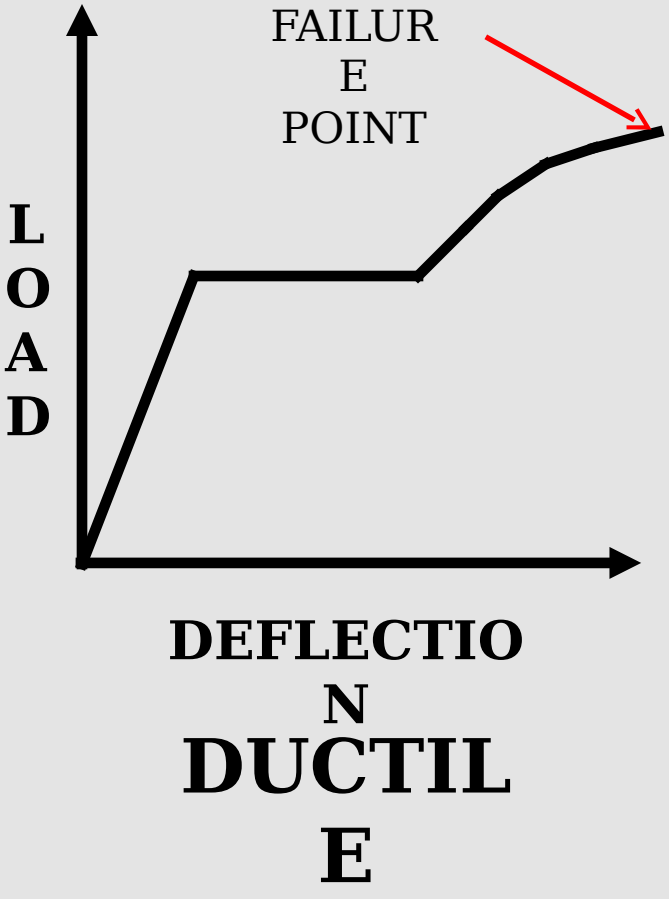


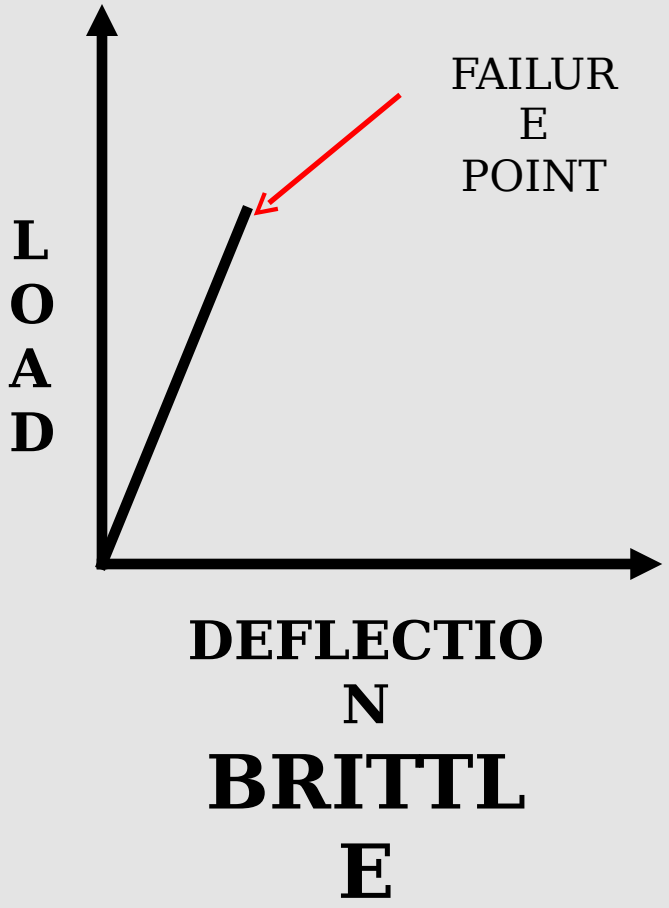


Material Properties
Brittle vs Ductile

- Wood
- Steel
- Reinforced Concrete
  - C.I.P. or P.C.
  - Rebar or Prestressed Cable
- Reinforced Masonry
- Unreinforced Masonry

Ductile Vs. Brittle Behavior

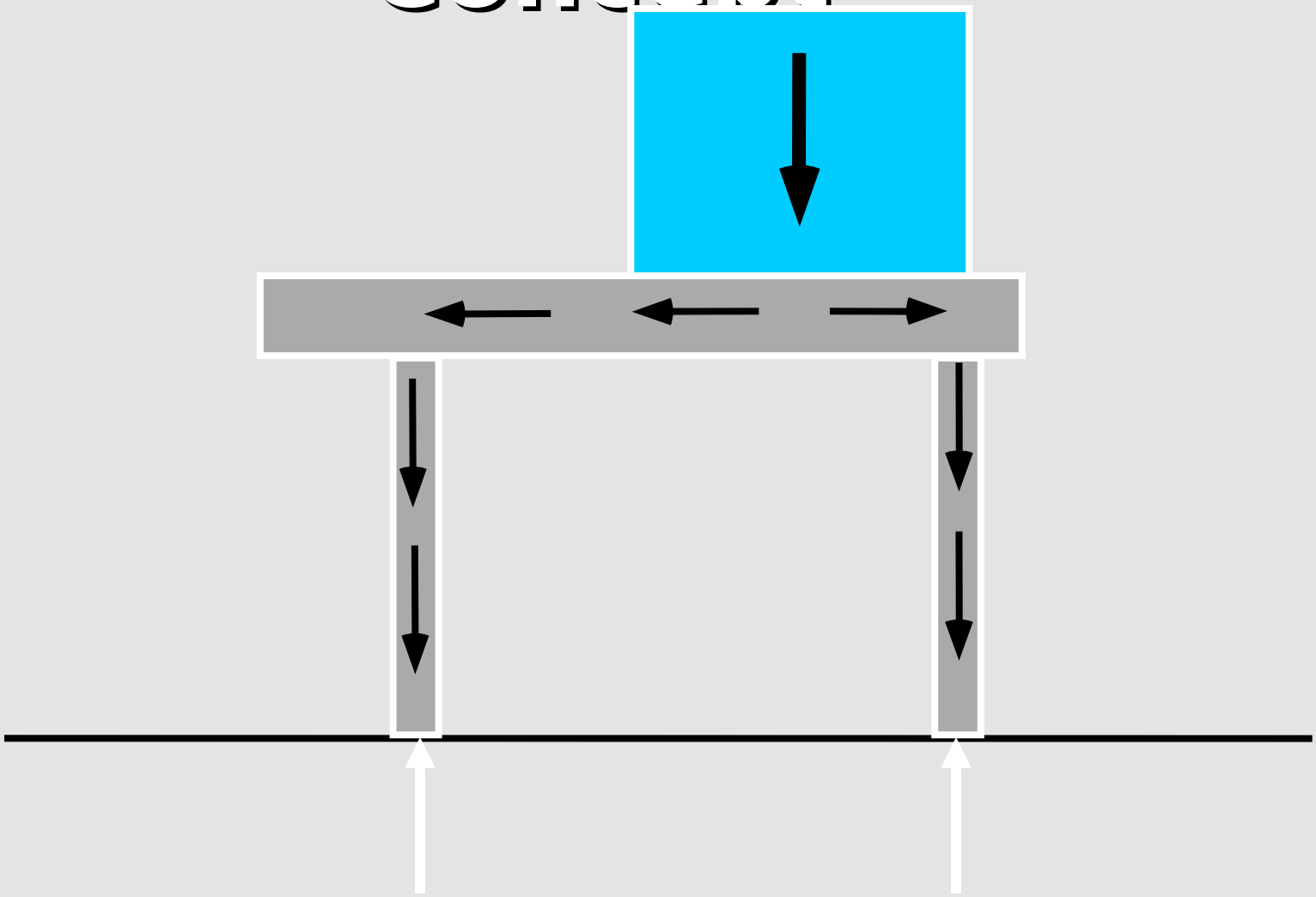




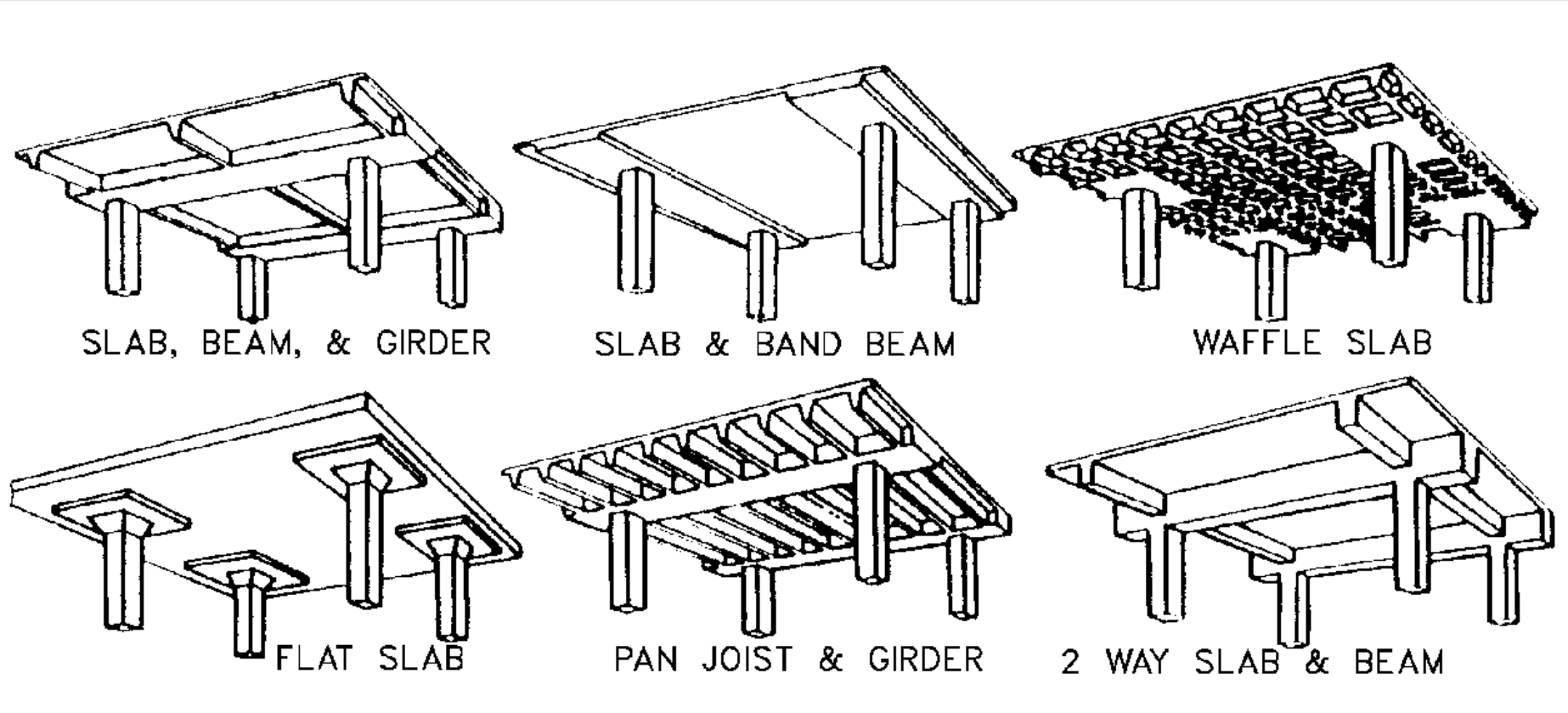
Vertical Load Systems

- Concept of gravity load path
- Loads must be transferred from Source to Ground
- Top down approach
  - Plumbing system analogy
- Framed and Un-Framed
- Connections are particularly vulnerable

Vertical Load Path Concept

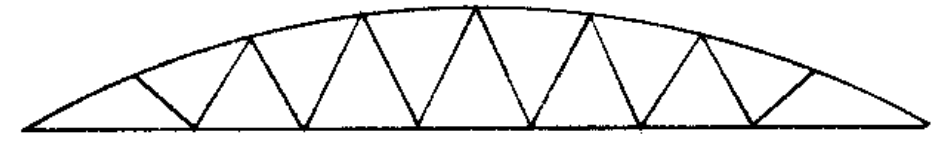


Concrete Floor Systems

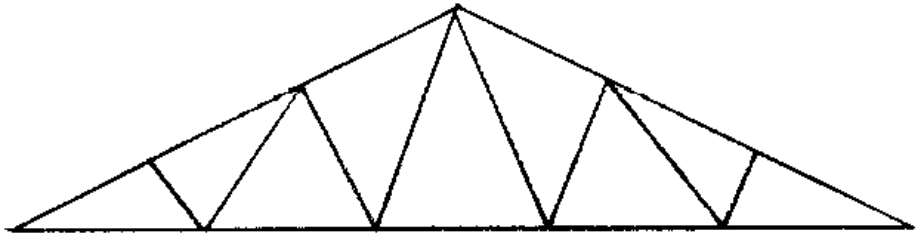


Most of the reinforcing steel is concentrat in and over Beams and over Columns

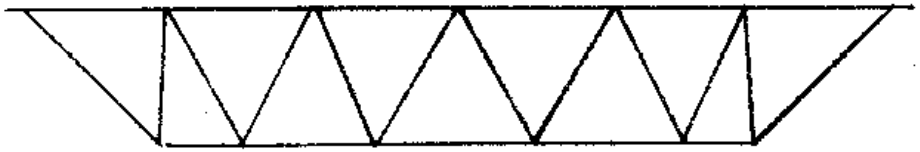
Typical Truss Configurations



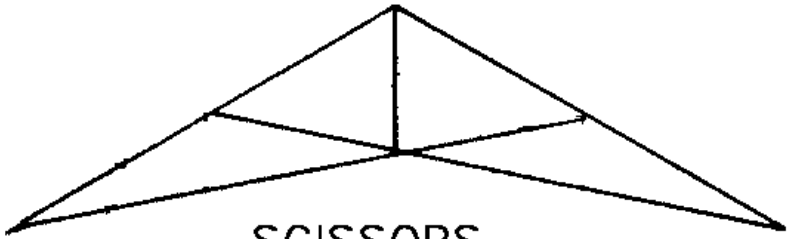
BOWSTRING



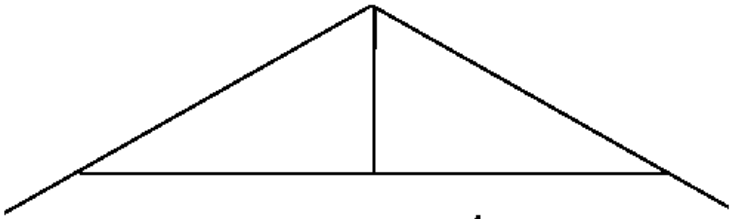
A OR W



PARALLEL CHORD



SCISSORS



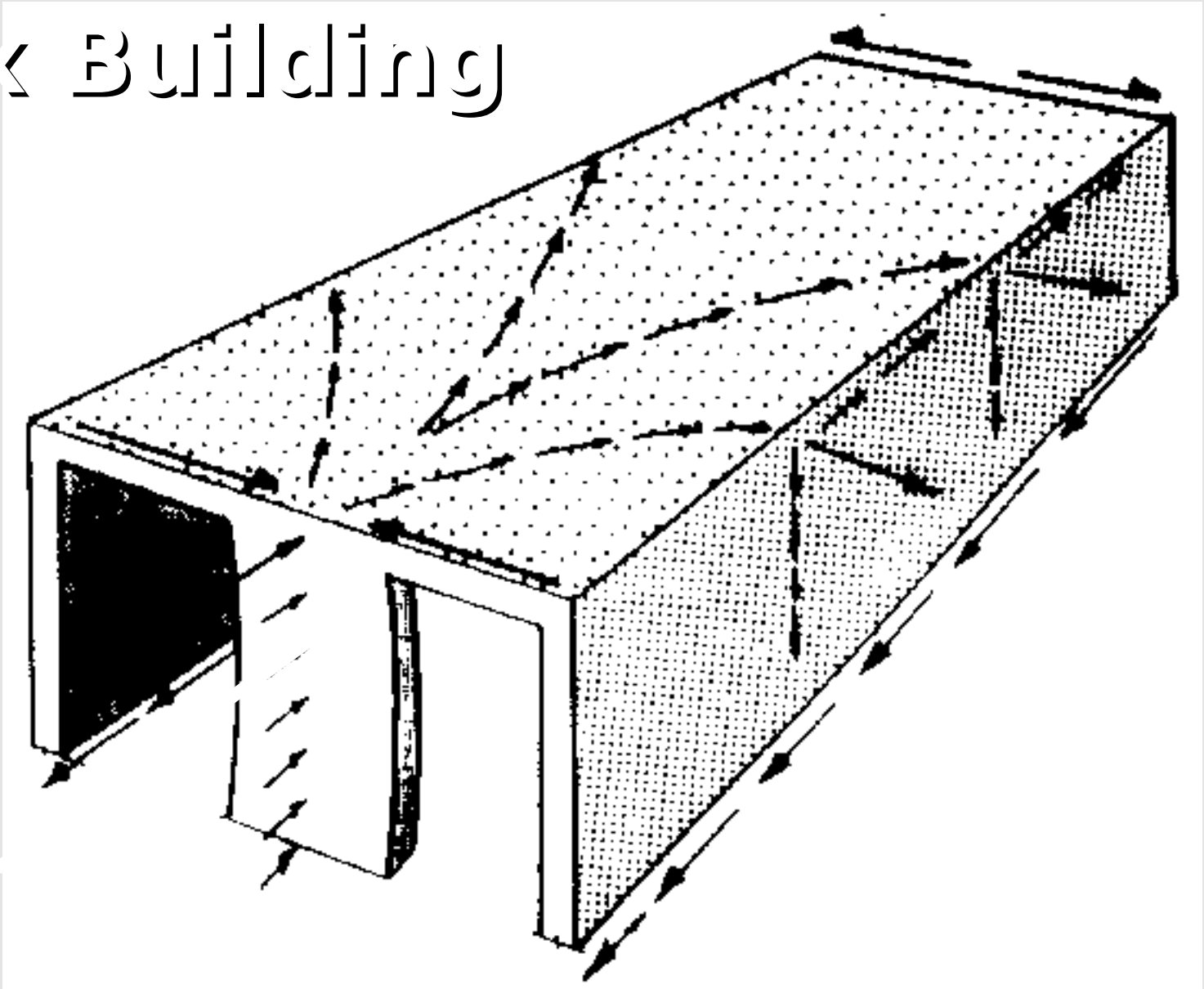
TIED RAFTER/ARCH

- Compression in top chords
- Small tension or compression. in diago

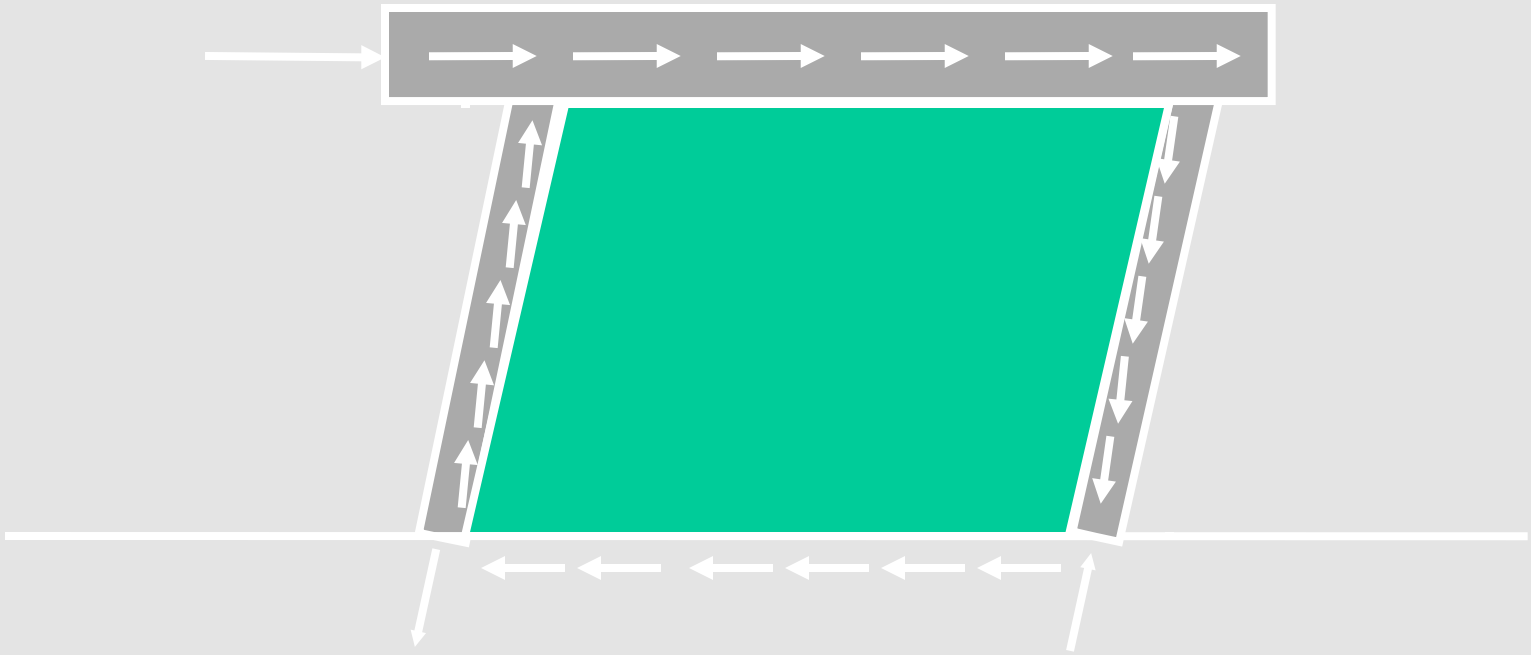
Lateral Load Resisting Systems

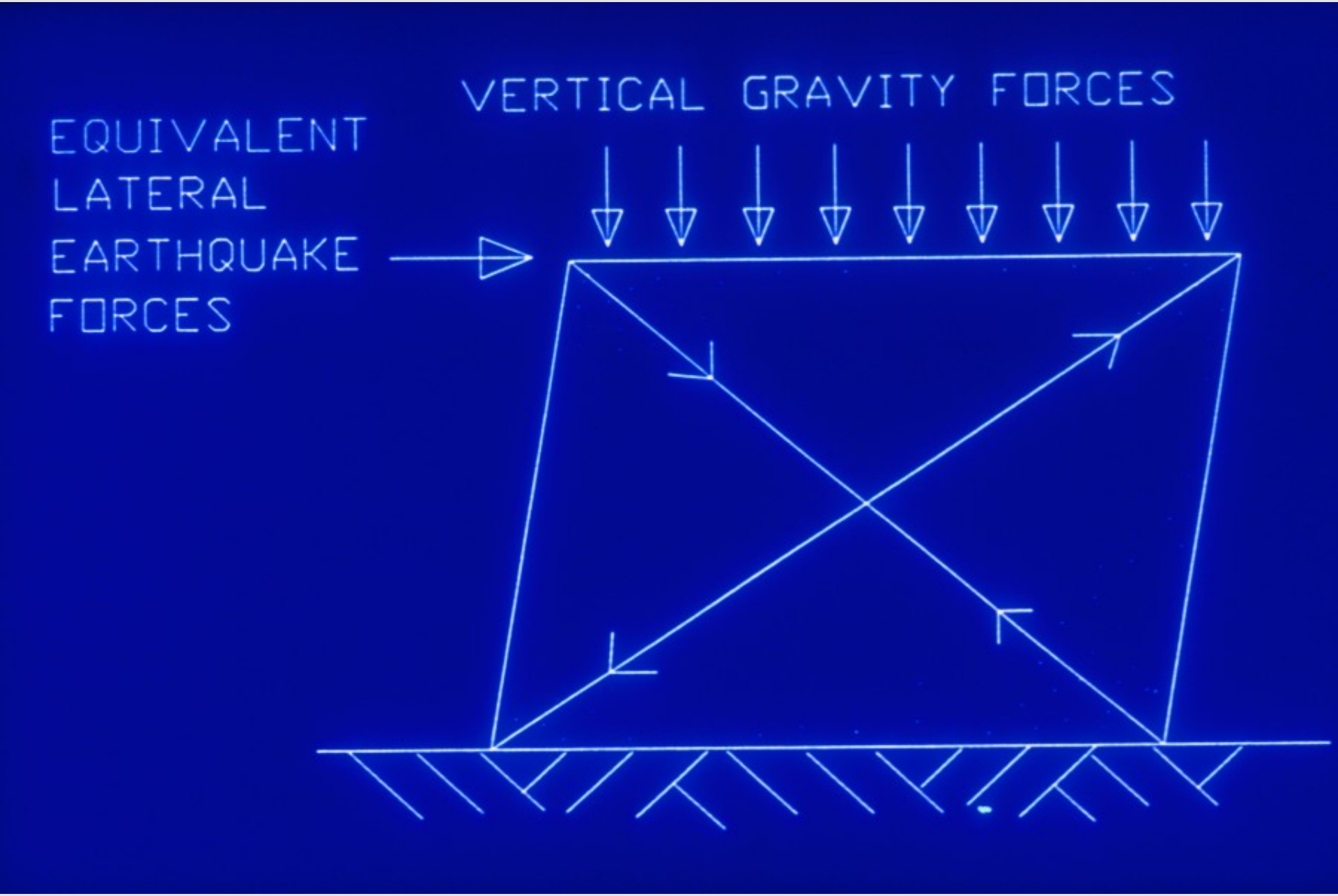
- Concept of load paths
- Pushover analogy
- Connections are particularly vulnerable
- Systems
  - Box Buildings
  - Moment Frames - (MUST BE DUCTILE)
  - Diagonally Braced Frames

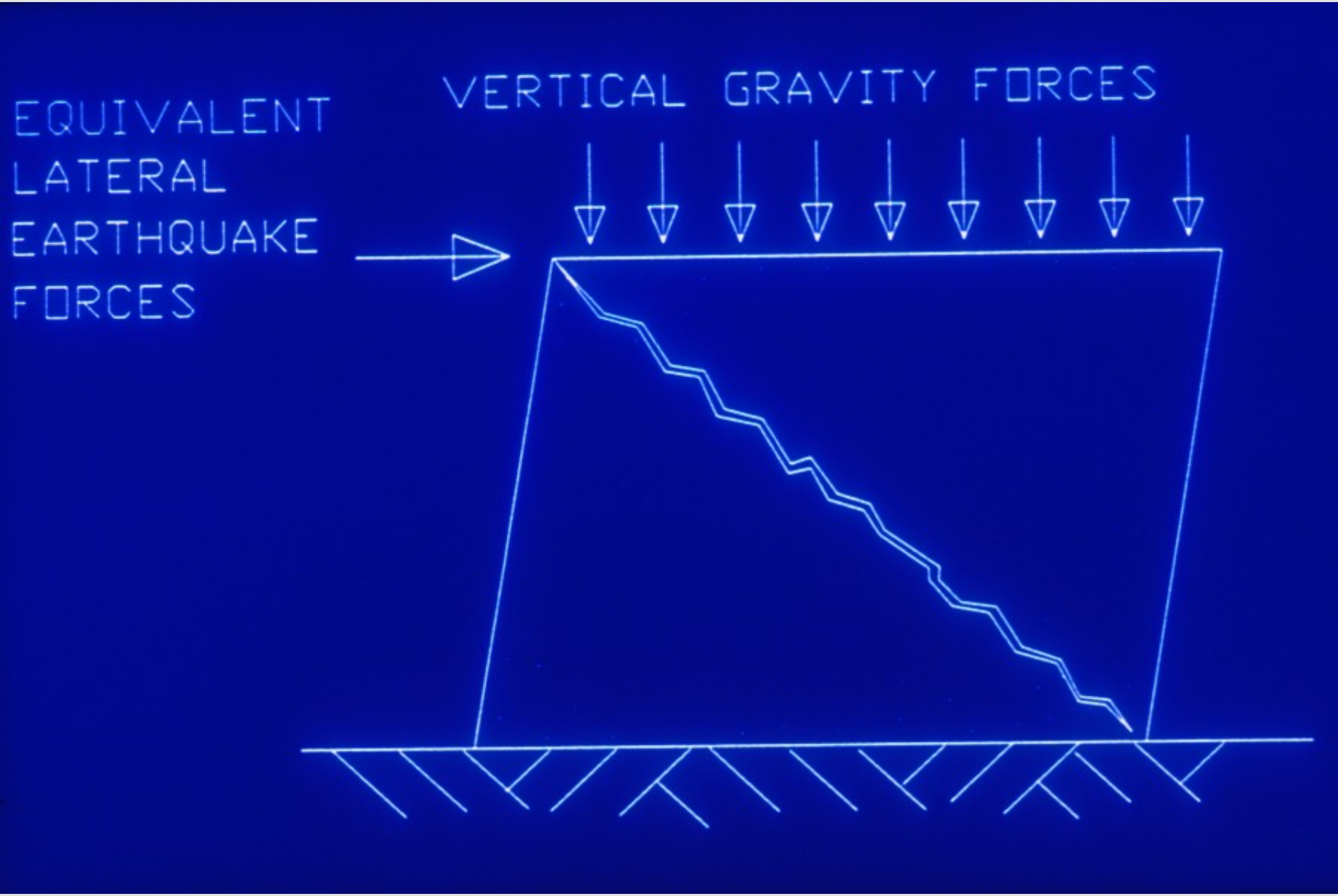
Box Building



Lateral Load Path Concept
Box Building




VERTICAL GRAVITY FORCES
EQUIVALENT
LATERAL
EARTHQUAKE
FORCES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EQUIVALENT
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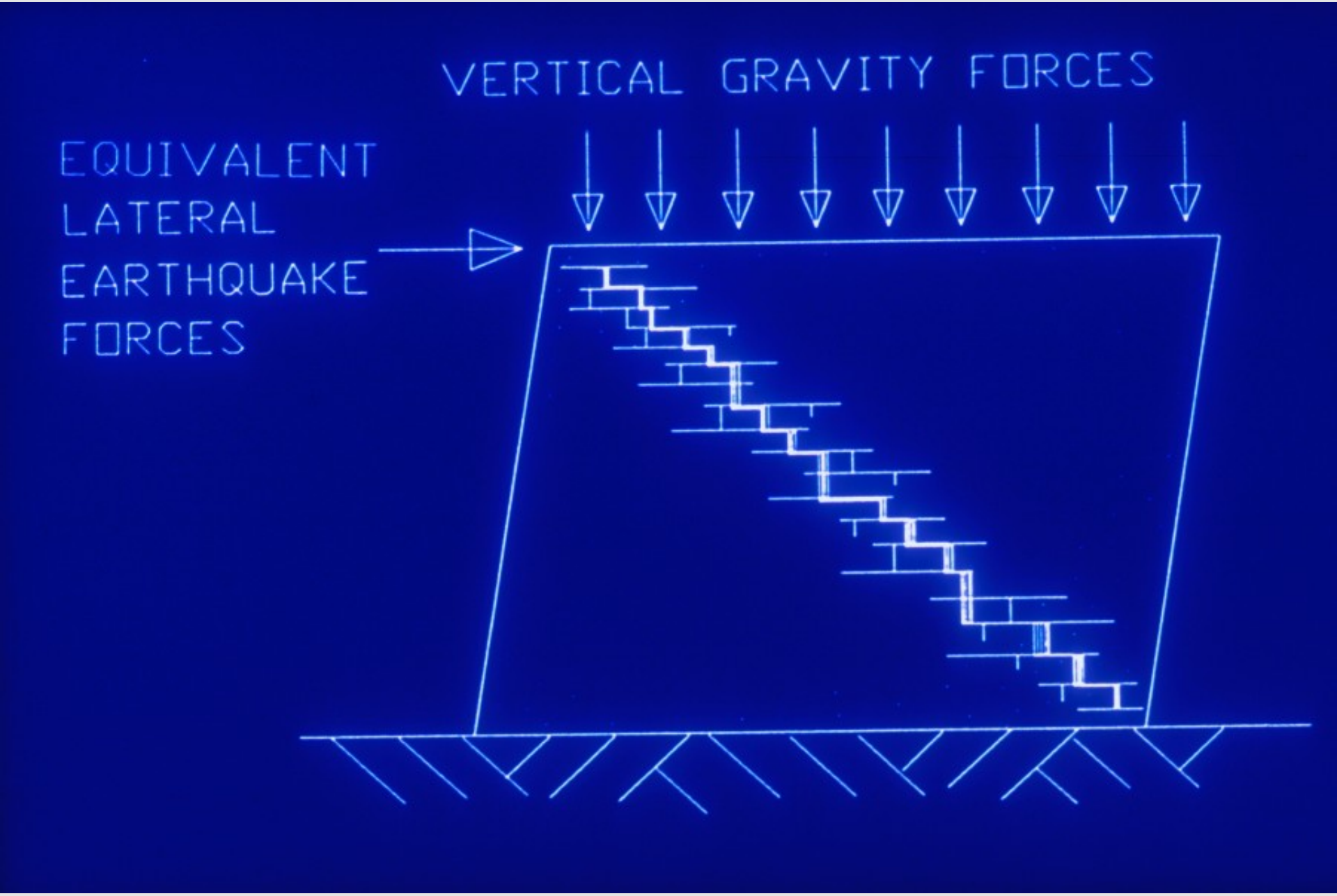
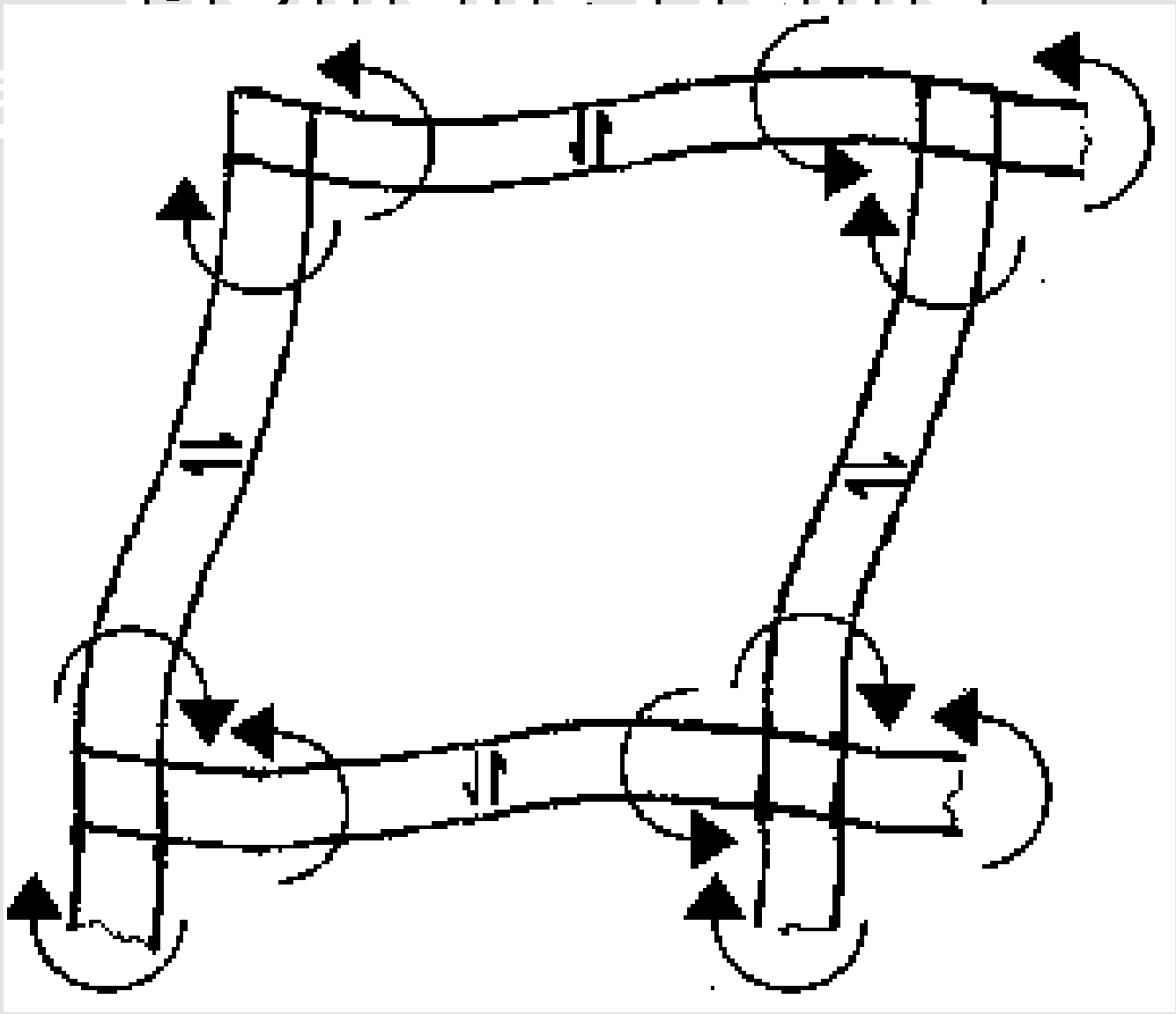
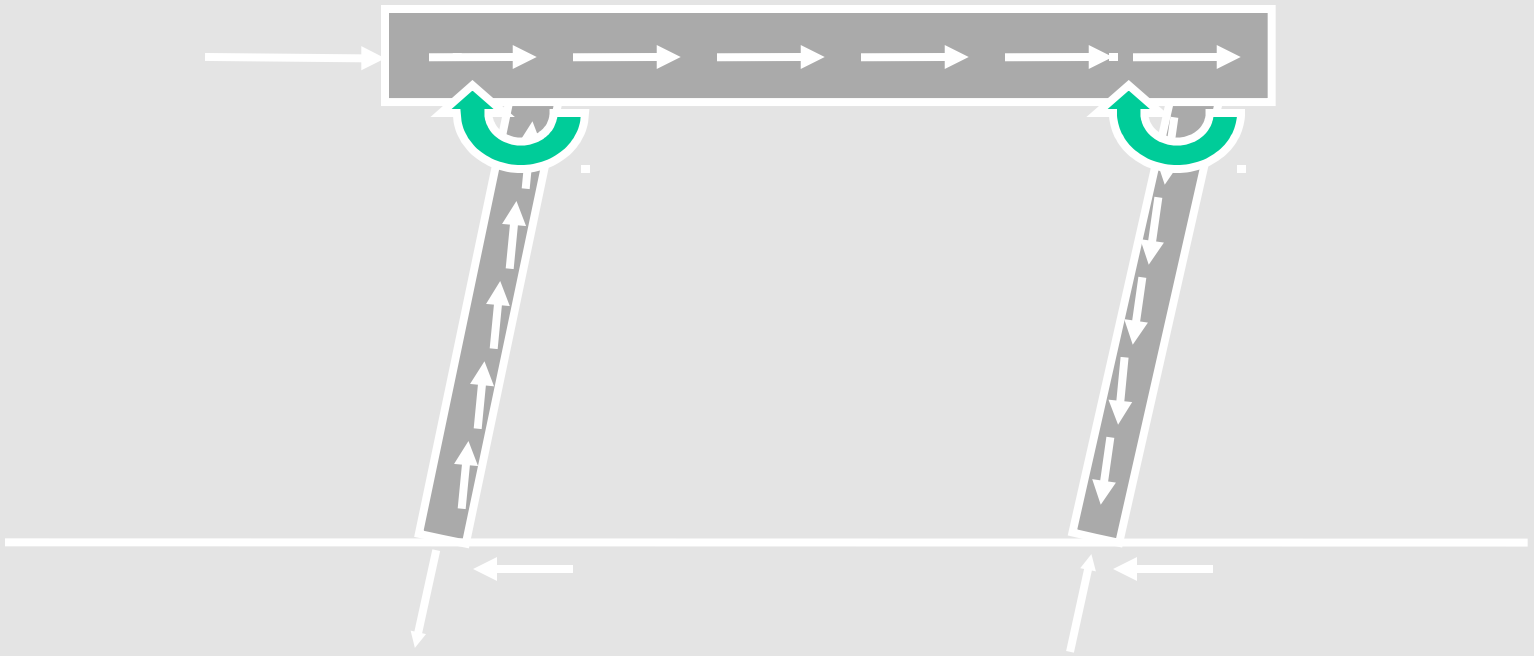
FORCES


VERTICAL GRAVITY FORCES
EQUIVALENT
LATERAL
EARTHQUAKE
FORCES

Moment Frame

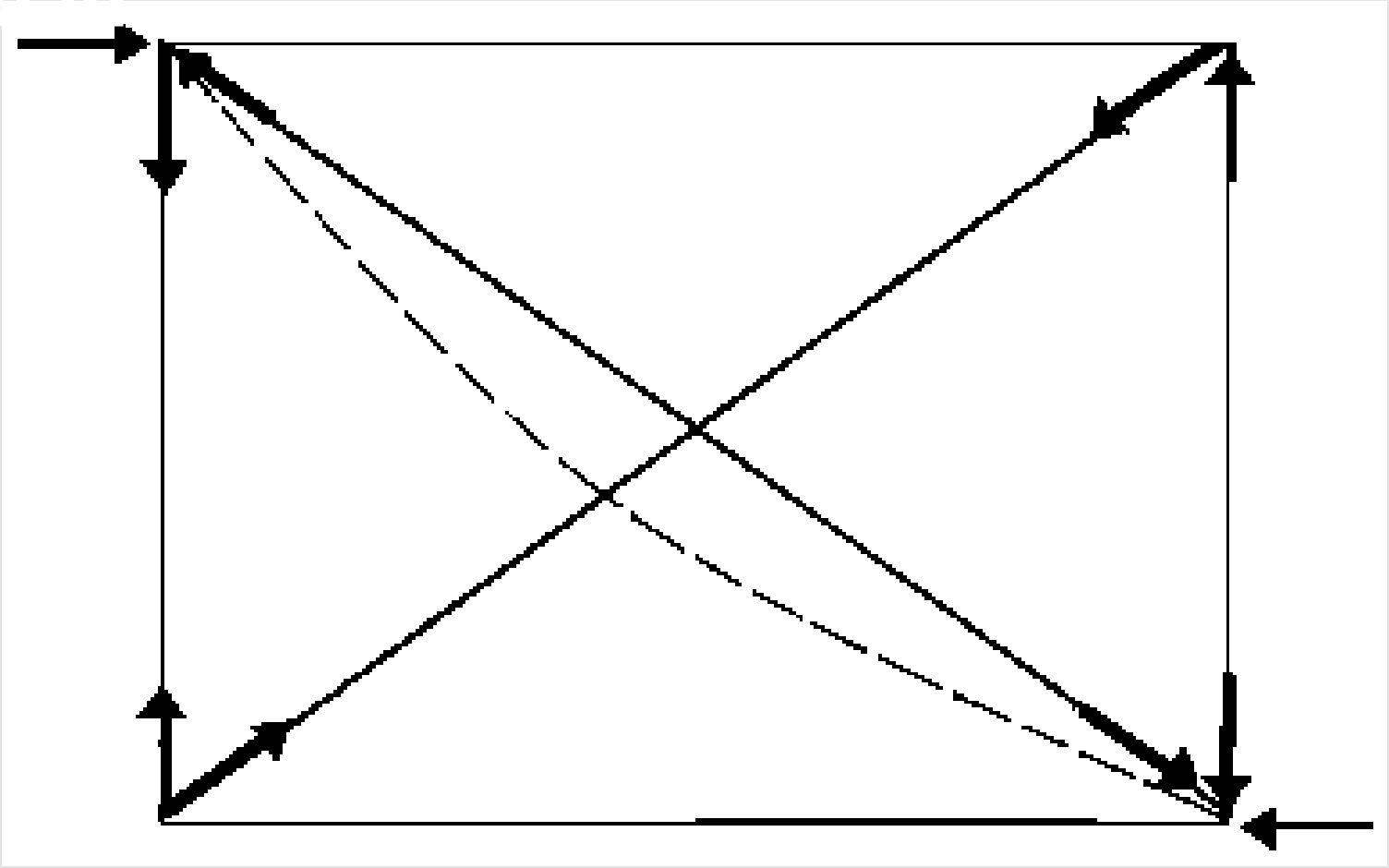


Lateral Load Path Concept
Moment Frame

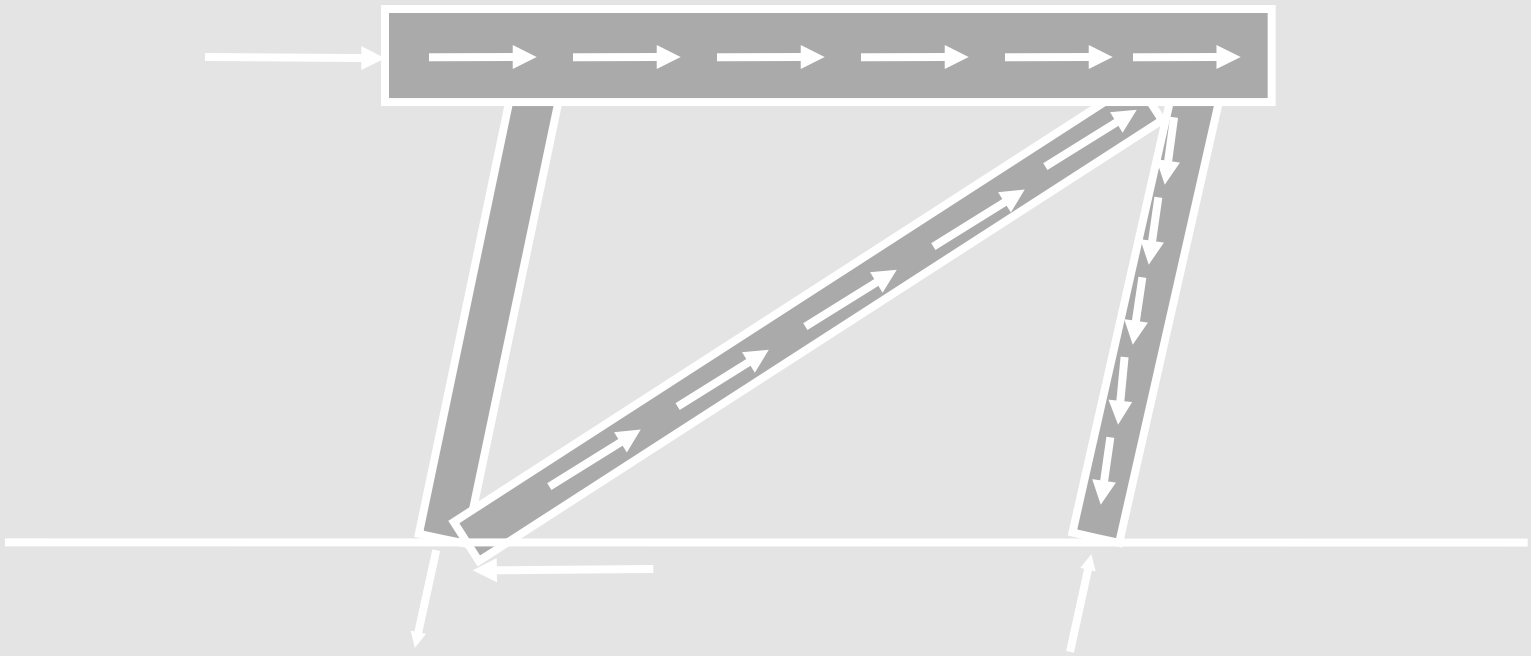


Diagonal Braced Frame

Lead



Lateral Load Path Concept
Diagonal Braced Frame

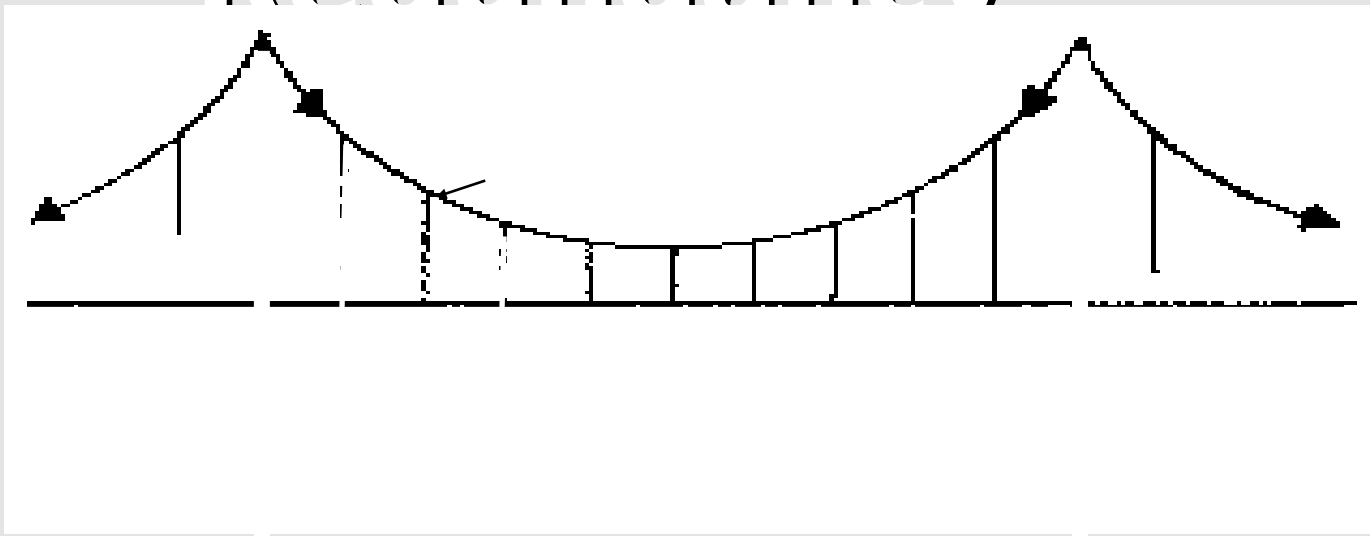


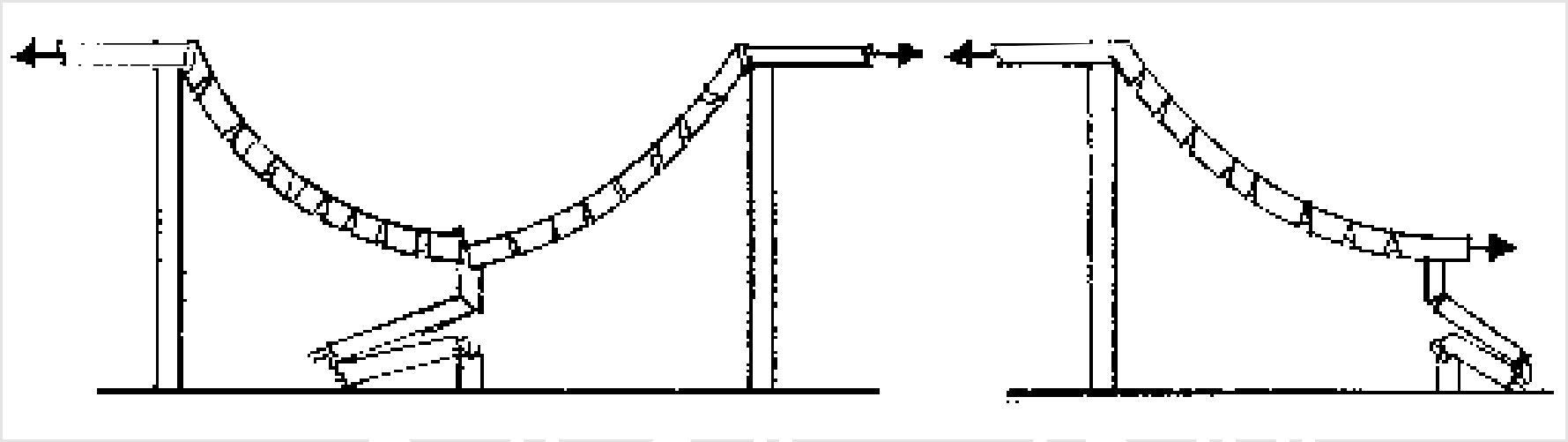
Redundancy

- **Multi - Elements**
  (at least 2 in every line of resistance)
  - **Box Buildings**
  - **Diagonal Braced Frames**
- **Majority of Connections**
  - **Moment Frames**
- **Dual Systems**
- **Collapse Preventers**

Tension Structure

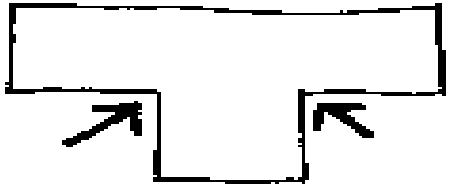
Redundancy



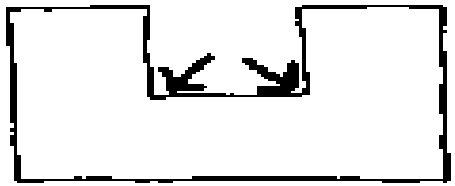


Partly Collapsed Building

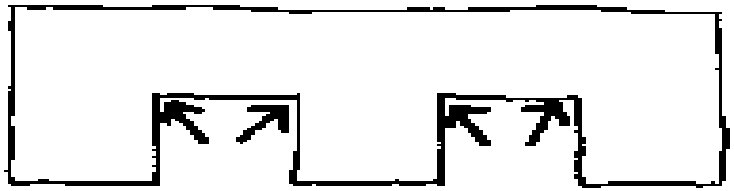
L-Shaped

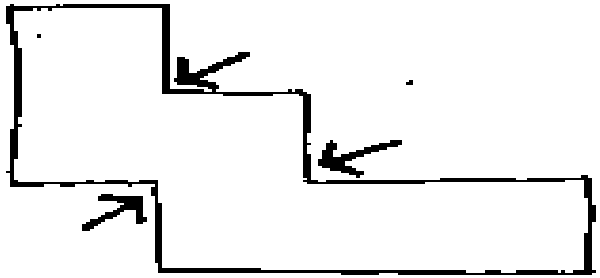


T-Shaped

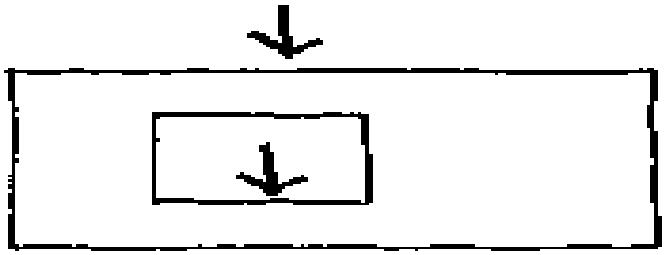


U-Shaped

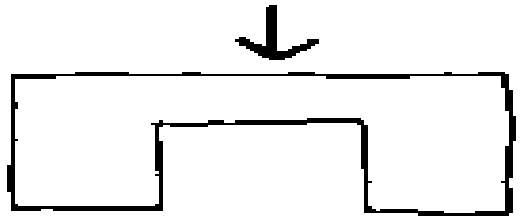




Other Complex Shapes



Large Opening in Diaphragm

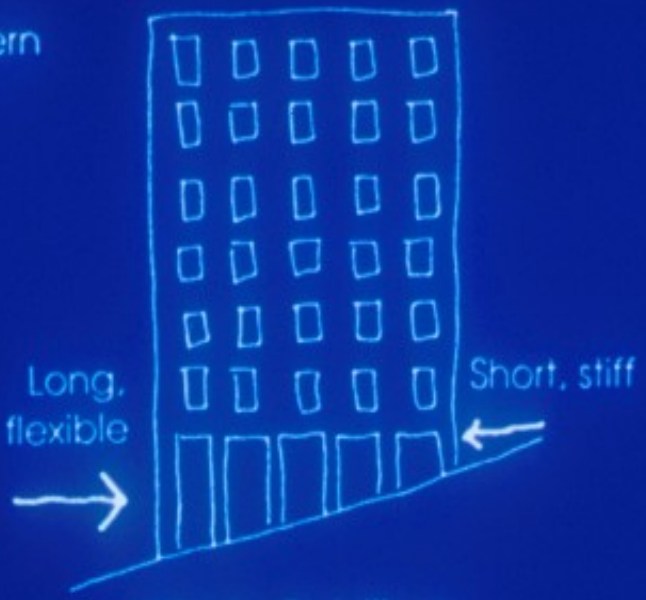


Weak Diaphragm Link

↑ = Area of particular concern

= Area of particular concern

Soft Stories

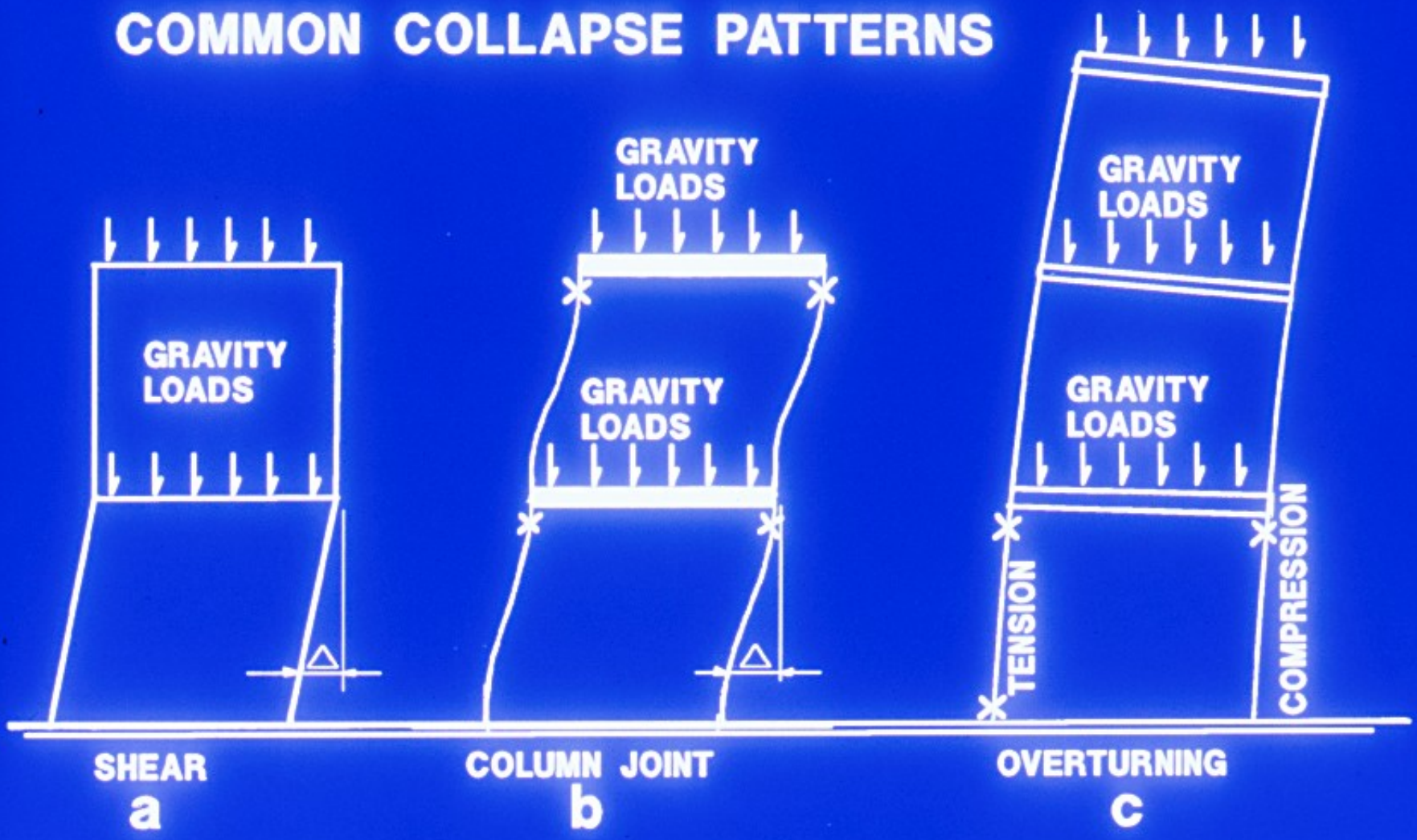


Hillside Buidlings

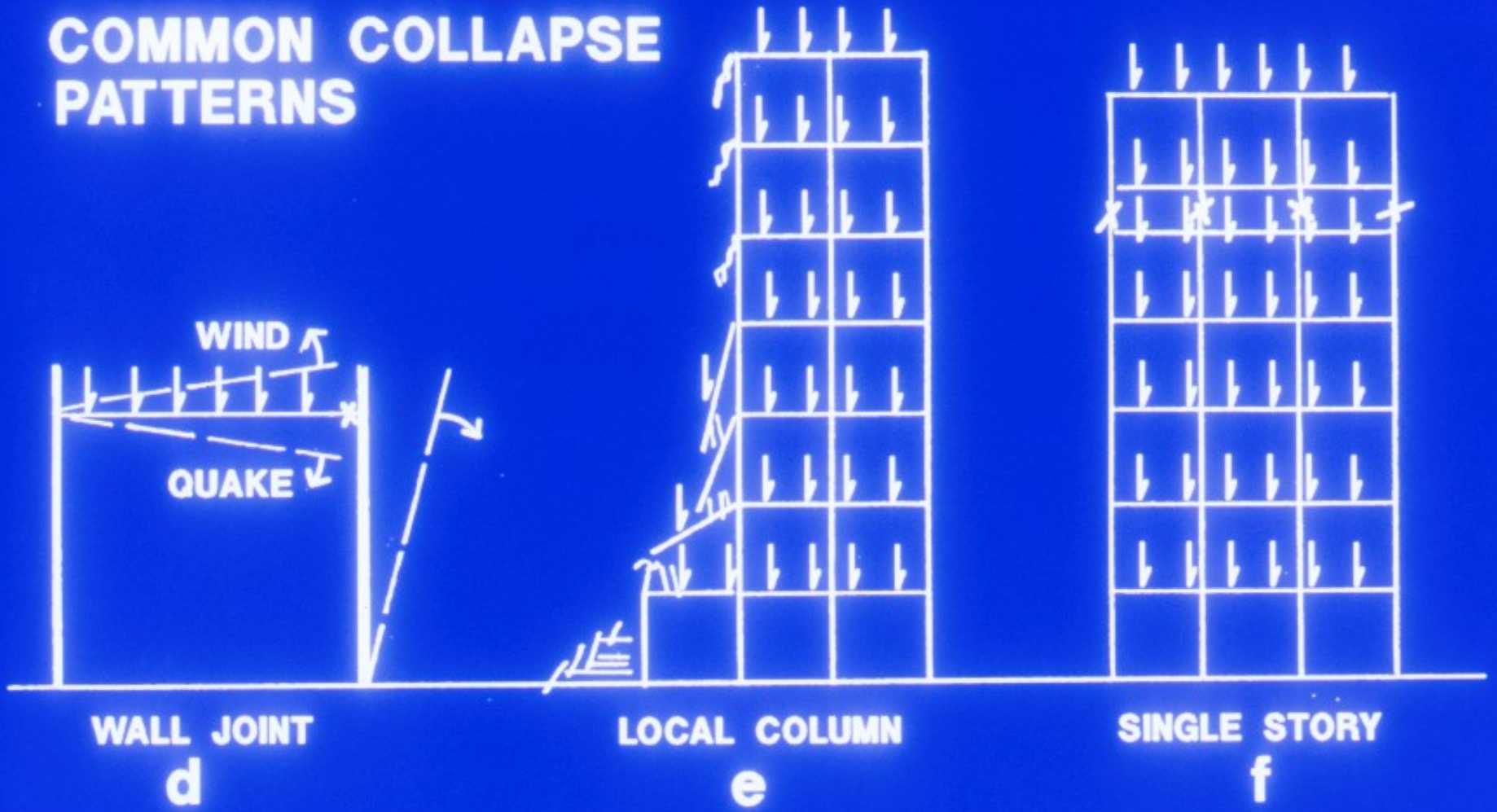
Setbacks

Coupled Shear Wall

COMMON COLLAPSE PATTERNS



COMMON COLLAPSE PATTERNS

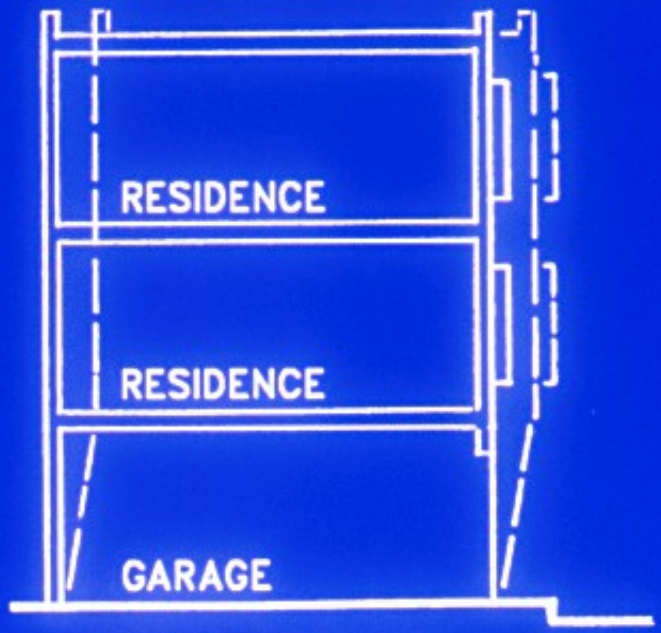


BASIC PRINCIPLES

- EARTHQUAKE SHAKING CAUSES DAMAGE TO STRUCTURAL LOAD RESISTING SYSTEM
- GRAVITY CAUSES STRUCTURAL COLLAPSE
- REDUNDANCY AND DUCTILE BEHAVIOR CAN PREVENT STRUCTURAL COLLAPSE
- BRITTLE BEHAVIOR ENHANCES POSSIBILITY OF STRUCTURAL COLLAPSE

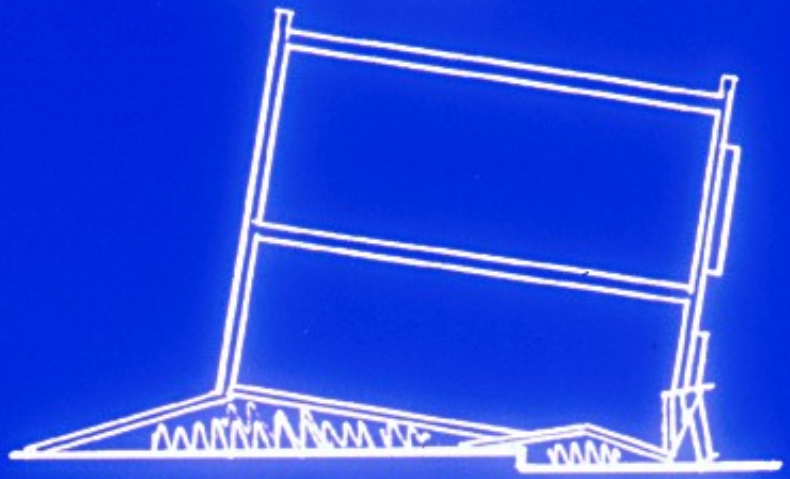
LIGHT FRAME COLLAPSE PATTERNS

BUILDING IS INITIALLY OFFSET BY EARTHQUAKE FORCES ACTING ON 1ST STORY WALLS THAT HAVE LOW SHEAR STRENGTH, DUE TO LARGE DOOR OPENINGS



INITIAL CONDITION

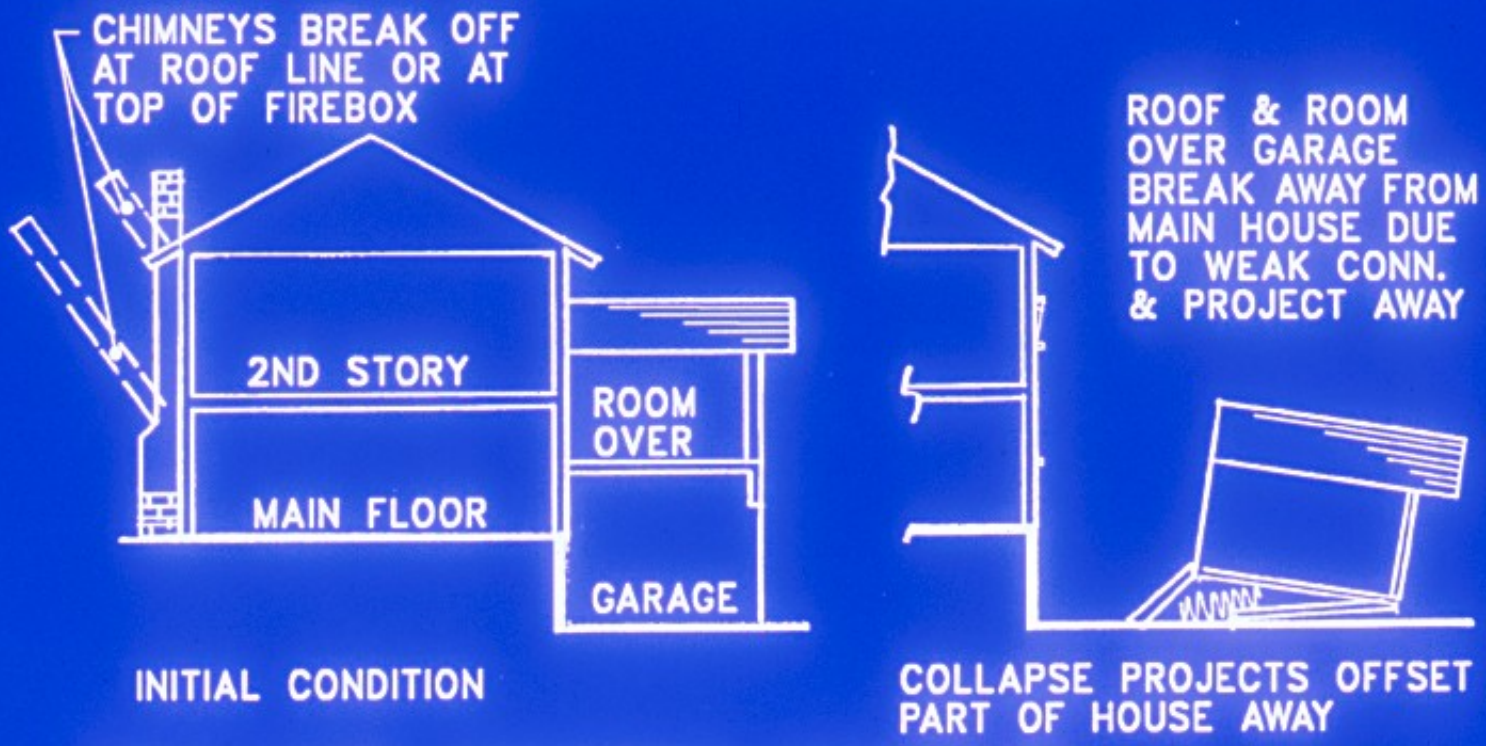
SINCE 1ST STORY WALLS ARE MORE THAN ADEQUATE TO SUPPORT RELATIVELY LT. WT. STORIES ABOVE, THEY KEEP THEIR ORIGINAL LENGTH & PROJECT THE UPPER STORIES AWAY FROM THE BLDG EDGE BY THE LENGTH OF THE IST STORY WALLS.



COLLAPSE PROJECTS STRUCTURE BEYOND IT'S BOUNDARY

TWO TO FOUR STORY RESIDENTIAL STRUCTURES

LIGHT FRAME COLLAPSE PATTERNS

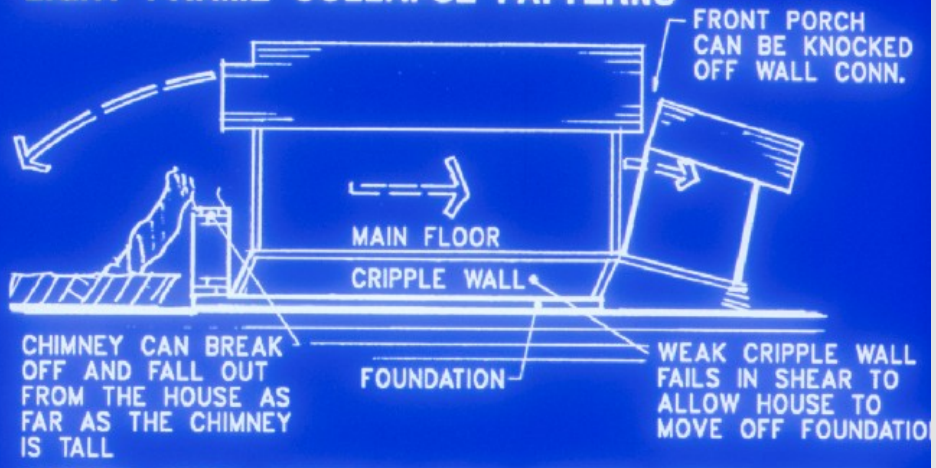

CHIMNEYS BREAK OFF AT ROOF LINE OR AT TOP OF FIREBOX
2ND STORY
MAIN FLOOR
ROOM OVER
GARAGE
ROOF & ROOM OVER GARAGE BREAK AWAY FROM MAIN HOUSE DUE TO WEAK CONN. & PROJECT AWAY

INITIAL CONDITION

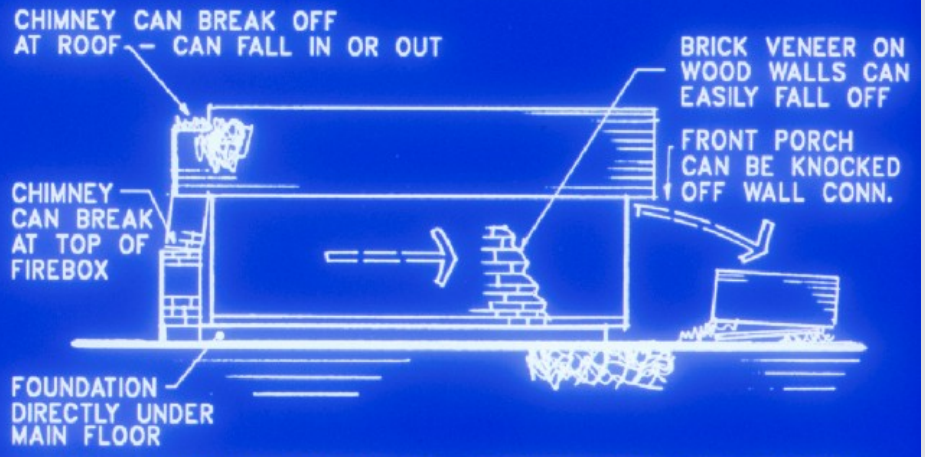
COLLAPSE PROJECTS OFFSET PART OF HOUSE AWAY

SPLIT LEVEL RESIDENCE STRUCTURE

LIGHT FRAME COLLAPSE PATTERNS


FRONT PORCH CAN BE KNOCKED OFF WALL CONN.
MAIN FLOOR
CRIPPLE WALL
CHIMNEY CAN BREAK OFF AND FALL OUT FROM THE HOUSE AS FAR AS THE CHIMNEY IS TALL
FOUNDATION
WEAK CRIPPLE WALL FAILS IN SHEAR TO ALLOW HOUSE TO MOVE OFF FOUNDATIO

HOUSE WITH CRIPPLE WALL UNDER FIRST FLOOR


CHIMNEY CAN BREAK OFF AT ROOF — CAN FALL IN OR OUT
BRICK VENEER ON WOOD WALLS CAN EASILY FALL OFF
FRONT PORCH CAN BE KNOCKED OFF WALL CONN.
CHIMNEY CAN BREAK AT TOP OF FIREBOX
FOUNDATION DIRECTLY UNDER MAIN FLOOR

HOUSE WITH FOUNDATION CONNECTING TO FLOOR

Summary – Part I

- **Earthquake, Wind, Floods**
- **Force Types**
- **Ductile vs Brittle**
- **Material Behavior**
- **Vertical Load Systems**
- **Lateral Load Resistant Systems**
- **Redundancy**
- **Collapse Patterns**

Summary – Part II

Procedures For Post Disaster Safety Evaluation Of Buildings (ATC–20)

TOPICS TO BE DISCUSSED

- Introduction to ATC Documents
- Posting System
- Evaluation Process
- Structure Types
- Non Structural Elements
- Geotechnical Hazards
- Hazmat & Safety
- Human Factors

ATC DOCUMENTS

- **Applied Technology Council**
  - **Established in 1971 by SEAOC**
- **ATC-20 Manual + ATC-20-1 FOG**
  - **Postearthquake Safety Evaluation**
  - **1987 Grant by CALOES & FEMA**
- **ATC-20-2 Addendum to Manual**
  - **1990 NSF Grant to review ATC-20**
- **ATC-26-3A FOG**
  - **1989 Grant by USPS**
  - **Added Wind and Flood Evaluation**

ATC 20
PROCEDURES FOR POSTEARTHQUAKE SAFETY EVALUATION OF BUILDINGS
ATC
APPLIED TECHNOLOGY COUNCIL
Funded by
Office of Emergency Services, State of California
Office of Statewide Health Planning and Development, State of California
Federal Emergency Management Agency
ATC-20-1
Field Manual: Postearthquake Safety Evaluation of Buildings
UNITED STATES POSTAL SERVICE
FIELD MANUAL: POST FLOOD AND WIND STORM SAFETY EVALUATION OF POSTAL BUILDINGS
FACILITIES DEPARTMENT

ATC-20-1 SECTIONS

Ch. 1 Introduction
Ch. 2 Overview of Evaluation Process
Ch. 3 Rapid Evaluation Method
Ch. 4 Detailed Evaluation Method
Ch. 5 Inspection & Posting Wood Frame
Ch. 6 Insp. & Post. Masonry
Ch. 7 Insp. & Post. Tilt-Up
Ch. 8 Insp. & Post. Concrete
Ch. 9 Insp. & Post. Steel Frame

ATC-20-1 SECTIONS (cont.)

Ch. 10 Insp. & Post. Geotechnical Hazards
Ch. 11 Insp. & Post. Nonstructural Hazards
Ch. 12 Inspection of Essential Facilities
App. A CALOES Volunteer Program
App. B Human factors following E.Q.
App. C Field Safety for Damage Inspectors
App. D Example 1 - Rapid Evaluation
App. E Example 2 - Detailed Evaluation
App. F ATC-20-1 Project Participants

EXAMPLE OF NEED

- **San Francisco - 1989 Loma Prieta E.Q.**
  - **Over 150,000 bldgs to evaluate**
  - **30 Building Inspectors**
  - **15 Civil or Structural Engineers**
  - **Over 3,000 bldgs per Inspector**
  - **People need to continue with their lives**
- **Following the 1989 Loma Prieta Quake volunteer engineers spent 2800 days doing Postearthquake Safety Evaluation**

PRINCIPAL SAFETY CONCERNS

- Collapse Hazards
- Falling Hazards
- Other Hazards
  - Hazmat
  - Anything that would compromise the SAFE occupancy of a building

BASIC APPROACH

- Right to Inspect
- Observe expected and unexpected damage
- Judgement in assessing RISK from damage
  - Need CONSISTENCY among Inspectors
- Not RISK vs REWARD of US&R

POSTING SYSTEM

- **INSPECTED (Green) - Appears Safe for Legal Occupancy**
- **LIMITED ENTRY/RESTRICTED USE (Yellow) - some restriction on use, controlled by Tenant**
- **UNSAFE (Red) - Entry controlled by Jurisdiction**
- **UNSAFE does not mean DEMOLISH**

INSPECTED

- No apparent hazard found, although repair may be required
- Observed damage, if any, does not

  appear to pose a safety risk
- Lawful entry, occupancy, and use is permitted

INSPECTED

NO RESTRICTION ON USE OR OCCUPANCY

This structure has been inspected (as indicated below) and no apparent structural hazard has been found. Report any unsafe conditions to local authorities; reinspection may be required.

☐ **Exterior Only**

☐ **Exterior and Interior**

Date _____

Time _____

This facility was inspected under emergency conditions for:

_____

(Jurisdiction)

on the date and time noted.

Facility Name and Address:

_____

_____

_____

_____

Inspector ID/Agency:

_____

_____

_____

_____

Do Not Remove this Placard until Authorized by Governing Authority.

LIMITED ENTRY/RESTRICTED USE

- Some risk from damage in all or part of building
- Restricted
  - Duration of occupancy
  - Areas of occupancy
  - Usage
- Restrictions are enforced by owner/manager
- Possible major aftershock hazard

LIMITED ENTRY

OFF LIMITS TO UNAUTHORIZED PERSONNEL

Warning:
This structure has been damaged and its safety is questionable. Enter only at own risk. Aftershocks or other events may result in death or injury.

Restrictions on use:

- ☐ Entry for emergency purposes only
- ☐ Other

_____

_____

Facility Name and Address:

_____

_____

_____

_____

Date _____

Time _____

This facility was inspected under emergency conditions for:

_____

(Jurisdiction)

on the date and time noted.

Inspector ID/Agency:

_____

_____

_____

_____

Do Not Remove this Placard until Authorized by Governing Authority.

Limited access near chimney, until removed

UNSAFE

- Unsafe for occupancy or entry; authorities may enter
- Falling, collapse, or other hazards
- Does not necessarily indicate demolition
- Owner must mitigate hazards to satisfaction of jurisdiction to gain entry

UNSAFE

DO NOT ENTER OR OCCUPY

Warning:
This structure has been seriously damaged and is unsafe. Do not enter. Entry may result in death or injury.

Comments:

_____
_____
_____
_____
_____

Facility Name and Address:

_____
_____
_____
_____

Date _____
Time _____

This facility was inspected under emergency conditions for:

_____
(Jurisdiction)

on the date and time noted.

Inspector ID/Agency:

_____
_____
_____
_____

Do Not Remove this Placard until Authorized by Governing Authority.

What about Access to adjacent bldgs?

CHANGING A POSTING

- To correct mistake or oversight
- After significant Aftershock
- Hired reevaluation and repair

POSTING REQUIREMENTS

- Should be Timely
- Should be Consistent
- Should be Visible
- Should Carry authority of Jurisdiction

WHAT SANTA CRUZ LEARNED AFTER LOMA PRIETA

- The city was under enormous pressure to provide access to damaged building
- Residents wanted to remove valued personal belongs - cash & documents
- Business owners wanted to remove inventory, computers, & files
- At each afternoon's city council meeting they pleaded for access

WHAT SANTA CRUZ LEARNED AFTER LOMA PRIETA

- Council had to decide whether to err on the side of access or safety
- Need for access was urgent, but dangers were real
- Occupants of even the most seriously damaged buildings were prepared to risk their lives to remove contents
- Final decisions about access were very difficult to make

LIABILITY ISSUES

- State Law in California
  - Engineers become disaster workers, if licensed, volunteer, and requested by Building Official
- Also O.K. if Deputized by Bldg Official
- Not problem if team contains one Building Official to do all posting
- Anyone is Liable for acts that are outside normal State of the Art
- State of the Art = 2 Person Team

PERSONAL EQUIPMENT

- **Essential**
  - drivers license
  - official I.D.
  - Credit cards, cash
  - backpack
  - eyeglasses/spare
  - prescription meds
  - hard hat
  - boots/sturdy shoes
  - rain gear/extra clothes
  - dust mask & gloves
  - hygiene supplies
- **Suggested**
  - Canteen
  - water purification
  - safety goggles
  - safety vest w/pockets
  - knee pads
  - sleeping bag
  - first aid kit
  - sunscreen & glasses

FIELD EQUIPMENT

- **Essential**
  - clipboard
  - paper/notebook
  - pens/pencils
  - flashlight and extra batteries
  - binoculars
  - plumb bob
- **Suggested**
  - portable battery-powered radio
  - camera equipment
  - cassette recorder +
  - tape measure
  - magnetic compass
  - swiss army knife
  - waterproof paper or notebook

EVALUATION PROCEDURES

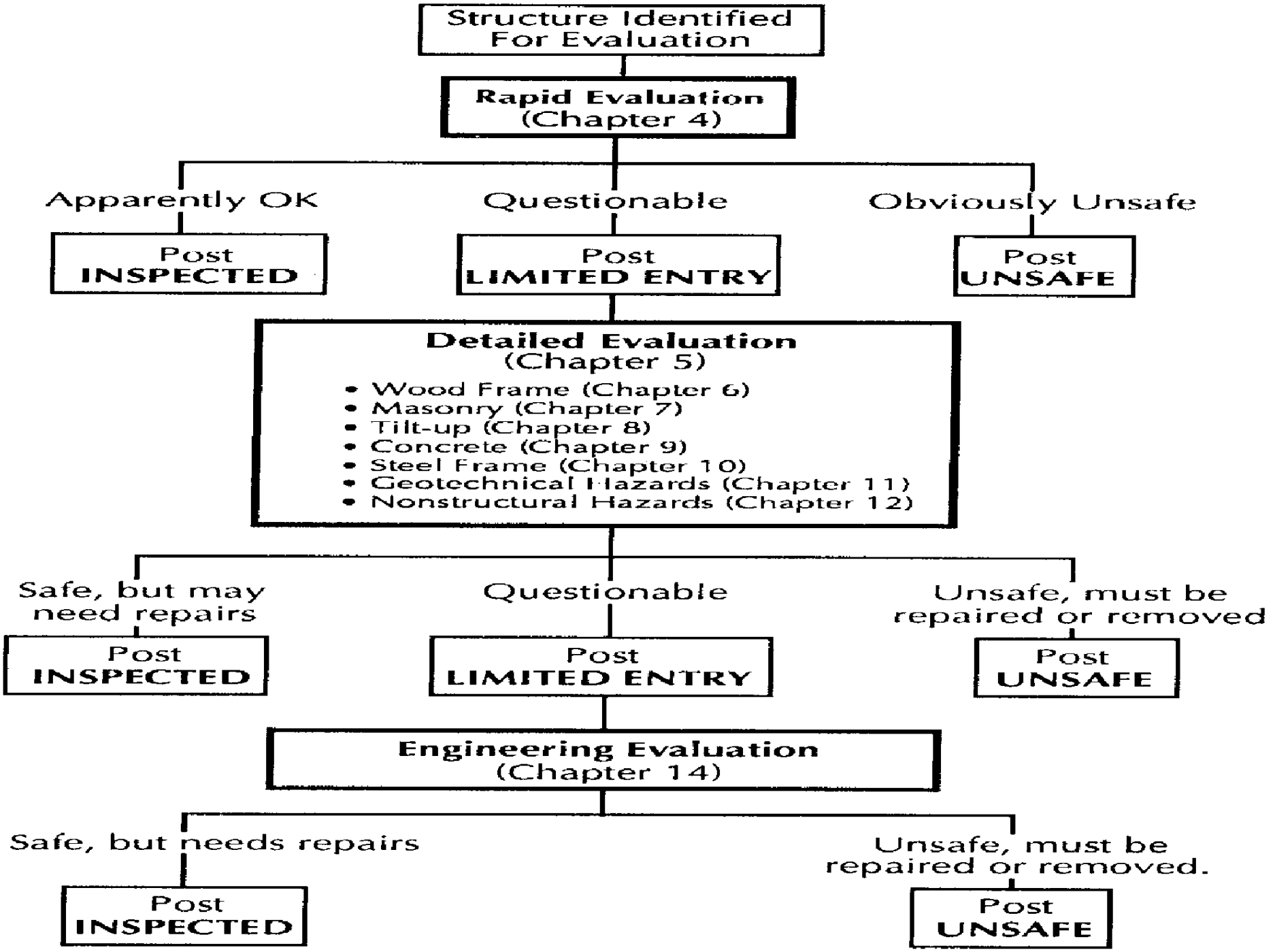
EVALUATION LEVELS

WINDSHIELD- Assess scope of damage in jurisdiction

RAPID- Assess more obvious and smaller buildings

DETAILED- Closer assessment of difficult buildings

ENGINEERING- Consultant hired by owner


Structure Identified For Evaluation
Rapid Evaluation (Chapter 4)
Apparently OK
Questionable
Obviously Unsafe
Post INSPECTED
Post LIMITED ENTRY
Post UNSAFE
Detailed Evaluation (Chapter 5)
• Wood Frame (Chapter 6)
• Masonry (Chapter 7)
• Tilt-up (Chapter 8)
• Concrete (Chapter 9)
• Steel Frame (Chapter 10)
• Geotechnical Hazards (Chapter 11)
• Nonstructural Hazards (Chapter 12)
Safe, but may need repairs
Questionable
Unsafe, must be repaired or removed
Post INSPECTED
Post LIMITED ENTRY
Post UNSAFE
Engineering Evaluation (Chapter 14)
Safe, but needs repairs
Unsafe, must be repaired or removed.
Post INSPECTED
Post UNSAFE

EVALUATION STEPS

- Examine entire outside of building
- Examine ground for distress
- Enter ONLY if SAFE & continue inspection
- Discuss observations w/partner
- Evaluate by criteria
- Post building
- Inform occupants of hazards

RAPID EVALUATION

- Evaluate and post buildings with most obvious conditions
- Recommend detailed evaluation for questionable buildings
- Inspect only OUTSIDE of building

RAPID EVALUATION CRITERIA

- Collapse, partial collapse
- Building or story noticeably leaning
- Severe racking of walls
- Obvious severe damage
- Chimney, parapet or other falling hazard
- Severe ground displacement or foundation damage
- Other hazards present

ATC-20 Rapid Evaluation Safety Assessment Form

Inspection

Inspector ID: _____ Inspection date and time: _____ ☐ AM ☐ PM

Affiliation: _____ Areas inspected: ☐ Exterior only ☐ Exterior and interior

Building Description

Building name: _____

Address: _____

_____

Building contact/phone: _____

Number of stories above ground: ____ below ground: ____

Approx. "Footprint area" (square feet): _____

Number of residential units: _____

Number of residential units not habitable: _____

Type of Construction

☐ Wood frame ☐ Concrete shear wall

☐ Steel frame ☐ Unreinforced masonry

☐ Tilt-up concrete ☐ Reinforced masonry

☐ Concrete frame ☐ Other: _____

Primary Occupancy

☐ Dwelling ☐ Commercial ☐ Government

☐ Other residential ☐ Offices ☐ Historic

☐ Public assembly ☐ Industrial ☐ School

☐ Emergency services ☐ Other: _____

Evaluation

Investigate the building for the conditions below and check the appropriate column.

Observed Conditions:	Minor/None	Moderate	Severe
Collapse, partial collapse, or building off foundation	☐	☐	☐
Building or story leaning	☐	☐	☐
Racking damage to walls, other structural damage	☐	☐	☐
Chimney, parapet, or other falling hazard	☐	☐	☐
Ground slope movement or cracking	☐	☐	☐
Other (specify) _____	☐	☐	☐

Estimated Building Damage (excluding contents)

☐ None

☐ 0–1%

☐ 1–10%

☐ 10–30%

☐ 30–60%

☐ 60–100%

☐ 100%

Comments: _____

_____

Posting

Choose a posting based on the evaluation and team judgment. *Severe* conditions endangering the overall building are grounds for an Unsafe posting. Localized *Severe* and overall *Moderate* conditions may allow a Restricted Use posting. Post INSPECTED placard at main entrance. Post RESTRICTED USE and UNSAFE placards at all entrances.

☐ **INSPECTED** (Green placard) ☐ **RESTRICTED USE** (Yellow placard) ☐ **UNSAFE** (Red placard)

Record any use and entry restrictions exactly as written on placard: _____

_____

_____

Further Actions

Check the boxes below only if further actions are needed.

☐ Barricades needed in the following areas: _____

_____

☐ Detailed Evaluation recommended: ☐ Structural ☐ Geotechnical ☐ Other: _____

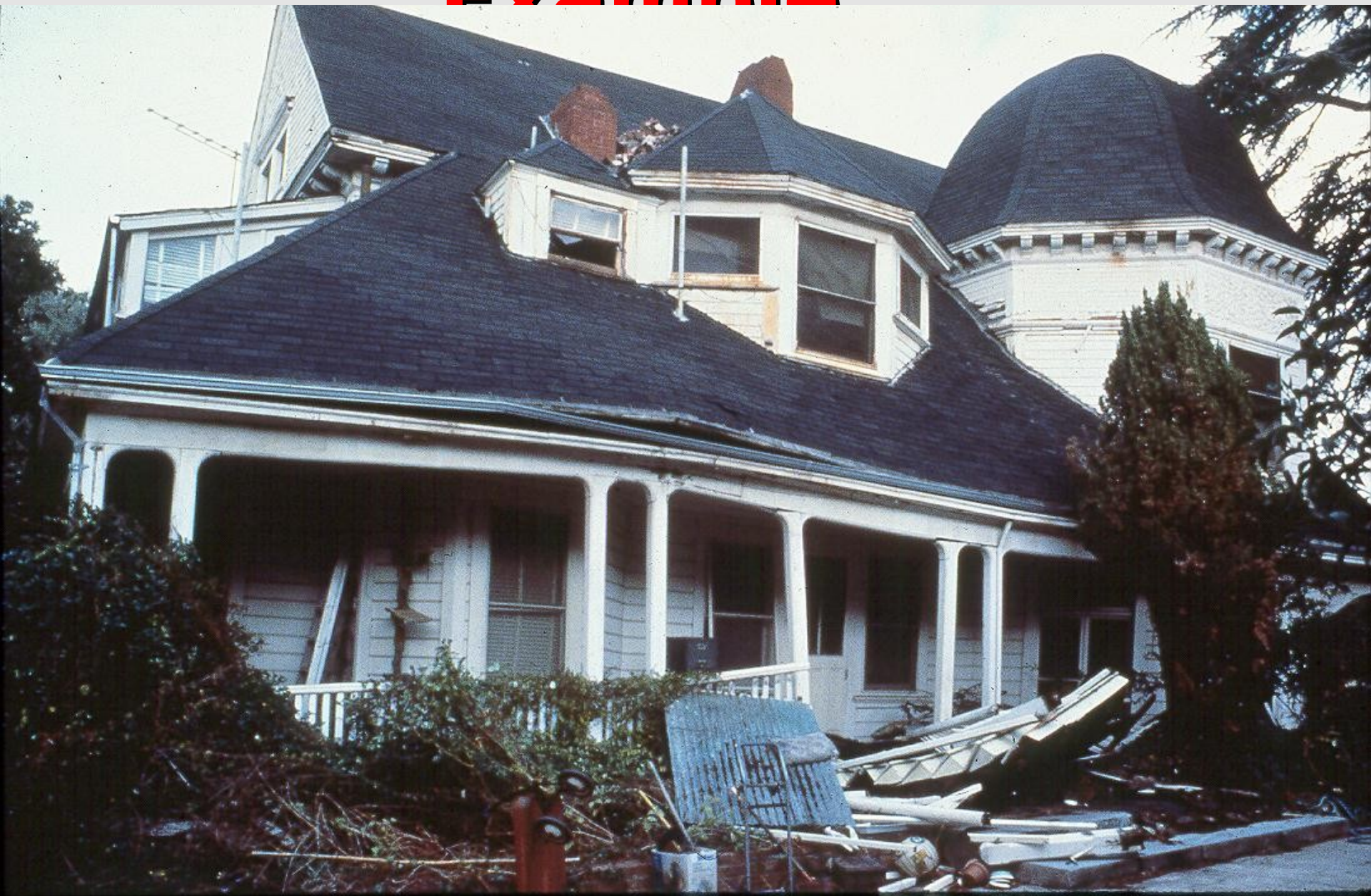
☐ Other recommendations: _____

Comments: _____

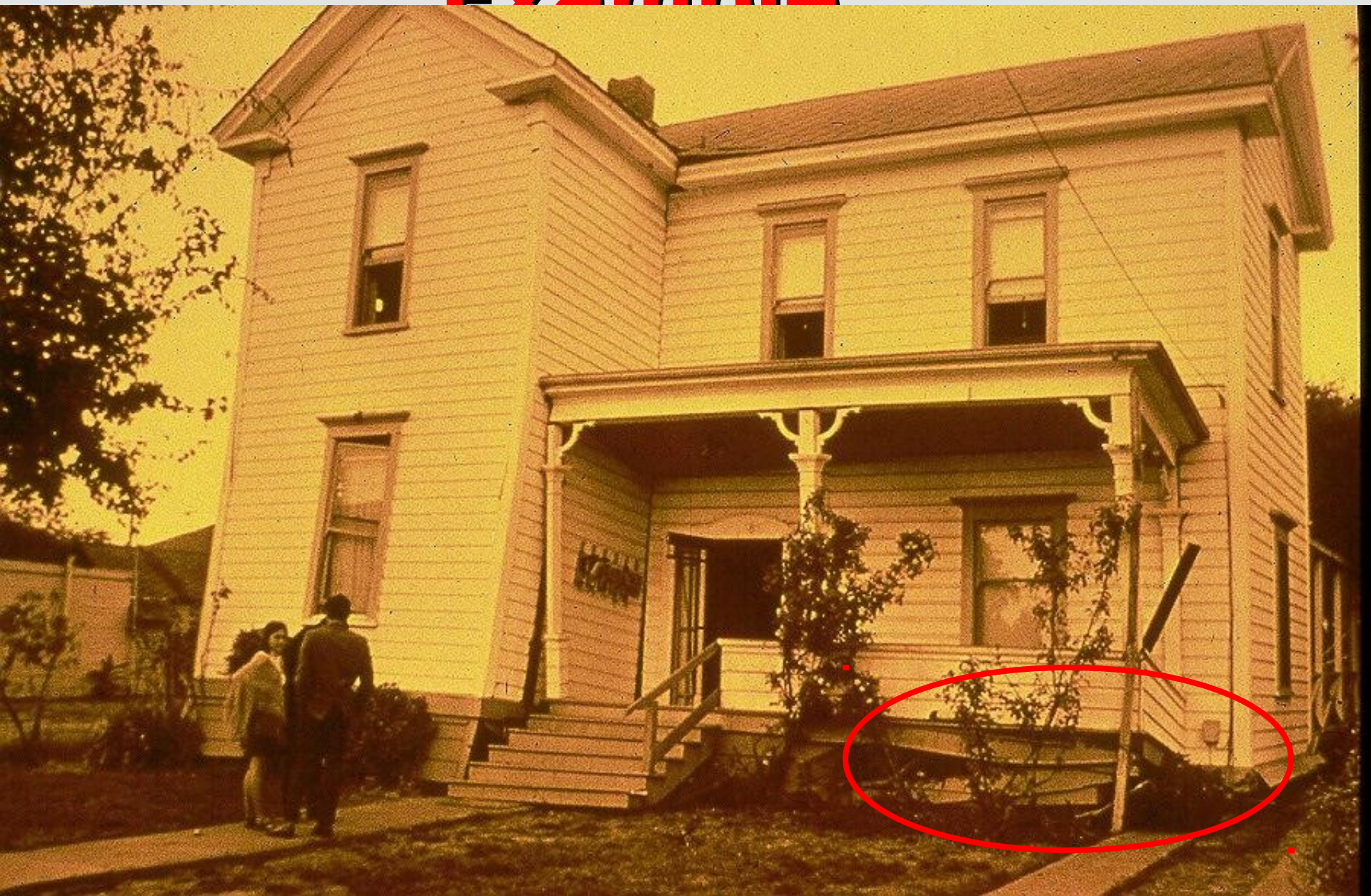
_____

New, revised Rapid Evaluation Form

Rapid Evaluation Example



Rapid Evaluation Example



UPPER HALF OF FORM

ATC-20 Rapid Evaluation Safety Assessment Form

Inspection

Inspector ID: #4321

Affiliation: OES VOLUNTEER

Inspection date and time: 4-29-89 4:45 ☐ AM ☒ PM

Areas inspected: ☒ Exterior only ☐ Exterior and interior

Building Description

Building name: JONES RESIDENCE

Address: 123 SOMEWHERE DR
SAND HILL, CA

Building contact/phone: _____

Number of stories above ground: 2 below ground: 0

Approx. "Footprint area" (square feet): 1400

Number of residential units: 1

Number of residential units not habitable: 1

Type of Construction

- ☒ Wood frame
- ☐ Steel frame
- ☐ Tilt-up concrete
- ☐ Concrete frame
- ☐ Concrete shear wall
- ☐ Unreinforced masonry
- ☐ Reinforced masonry
- ☐ Other: _____

Primary Occupancy

- ☒ Dwelling
- ☐ Other residential
- ☐ Public assembly
- ☐ Emergency services
- ☐ Commercial
- ☐ Offices
- ☐ Industrial
- ☐ Other: _____
- ☐ Government
- ☐ Historic
- ☐ School

Evaluation

Investigate the building for the conditions below and check the appropriate column.

Observed Conditions:	Minor/None	Moderate	Severe
Collapse, partial collapse, or building off foundation	☐	☐	☒
Building or story leaning	☐	☒	☐
Racking damage to walls, other structural damage	☐	☒	☐
Chimney, parapet, or other falling hazard	☐	☒	☐
Ground slope movement or cracking	☒	☐	☐
Other (specify) SEVERED GAS LINE	☐	☐	☒

Estimated Building Damage (excluding contents)

☐ None
☐ 0–1%
☐ 1–10%
☐ 10–30%
☒ 30–60%
☐ 60–100%
☐ 100%

Comments: HOUSE HAS MOVED 1 TO 2 FT OFF FOUNDATION. CRIPPLE WALL FAILURE. SEVERED GAS LINE HAS BEEN SHUT OF BY GAS CO.

Posting

Choose a posting based on the evaluation and team judgment. *Severe* conditions endangering the overall building are grounds for an Unsafe posting. Localized *Severe* and overall *Moderate* conditions may allow a Restricted Use posting. Post INSPECTED placard at main entrance. Post RESTRICTED USE and UNSAFE placards at all entrances.

☐ **INSPECTED** (Green placard) ☐ **RESTRICTED USE** (Yellow placard) ☒ **UNSAFE** (Red placard)

Record any use and entry restrictions exactly as written on placard: _____

Further Actions

Check the boxes below only if further actions are needed.

☐ Barricades needed in the following areas: _____

☐ Detailed Evaluation recommended: ☐ Structural ☐ Geotechnical ☐ Other: _____

☐ Other recommendations: _____

Comments: HOUSE REQUIRES MAJOR REPAIRS

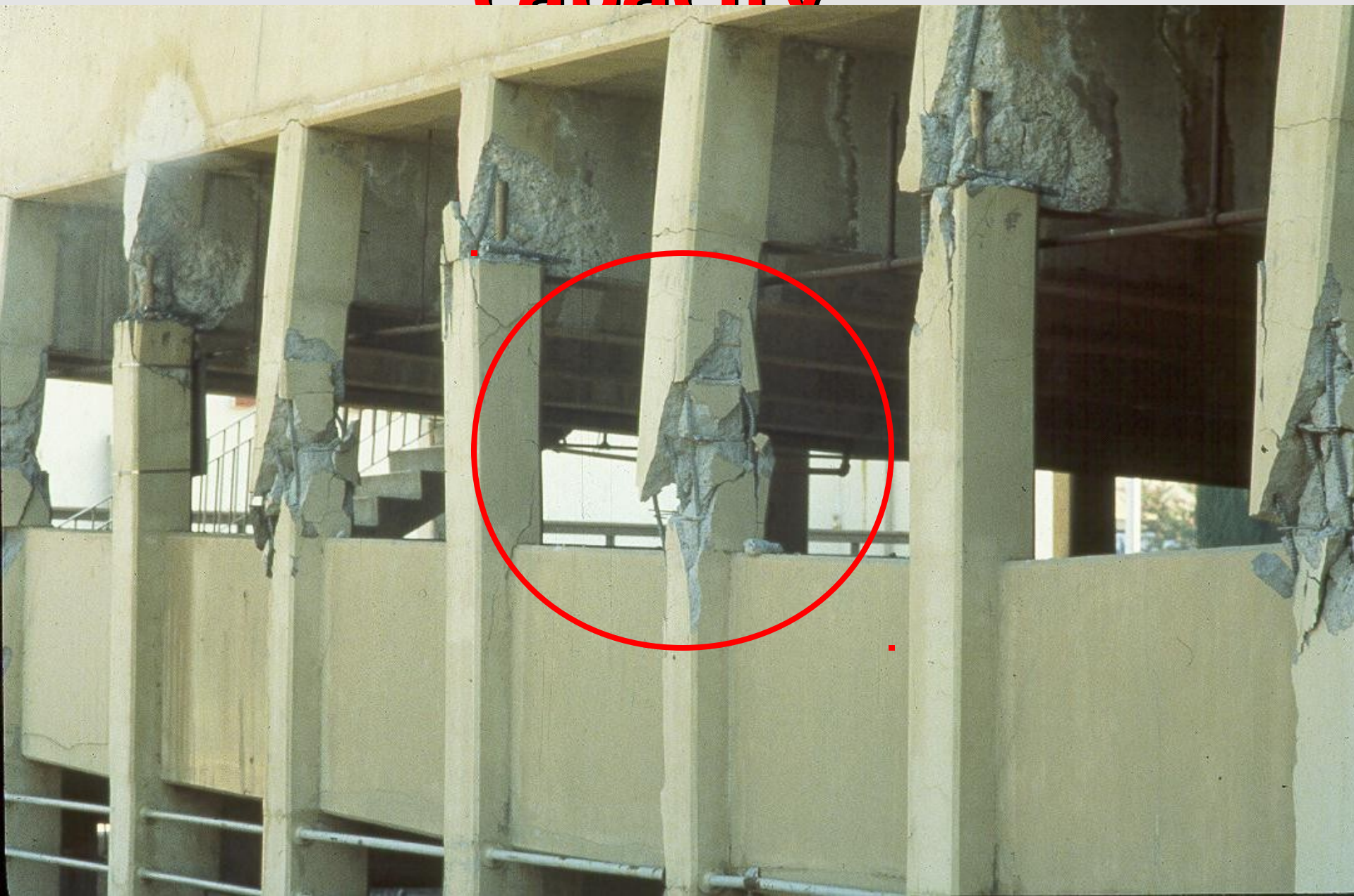
DETAILED EVALUATION

- Careful exterior and interior visual examination by qualified team
- Follow rapid evaluation when required
- Important for essential facilities

DETAILED EVALUATION CRITERIA

- Vertical load capacity not significantly decreased
- Lateral load capacity not significantly decreased
- No falling or other hazards present
- No evidence of foundation damage or ground displacement
- Main exits useable
- No other unsafe condition

Decreased vertical load capacity



ATC-20 Detailed Evaluation Safety Assessment Form

Inspection

Inspector ID: _____

Affiliation: _____

Inspection date and time: _____ ☐ AM ☐ PM

Final Posting
from page 2

☐ Inspected
☐ Restricted Use
☐ Unsafe

Building Description

Building name: _____

Address: _____

_____

Building contact/phone: _____

Number of stories above ground: ____ below ground: ____

Approx. "Footprint area" (square feet): _____

Number of residential units: _____

Number of residential units not habitable: _____

Type of Construction

☐ Wood frame
☐ Steel frame
☐ Tilt-up concrete
☐ Concrete frame
☐ Concrete shear wall
☐ Unreinforced masonry
☐ Reinforced masonry
☐ Other: _____

Primary Occupancy

☐ Dwelling
☐ Other residential
☐ Public assembly
☐ Emergency services
☐ Commercial
☐ Offices
☐ Industrial
☐ Other: _____
☐ Government
☐ Historic
☐ School

Evaluation

Investigate the building for the conditions below and check the appropriate column. There is room on the second page for a sketch.

	Minor/None	Moderate	Severe	Comments
Overall hazards:				
Collapse or partial collapse	☐	☐	☐	_____
Building or story leaning	☐	☐	☐	_____
Other_____	☐	☐	☐	_____
Structural hazards:				
Foundations	☐	☐	☐	_____
Roofs, floors (vertical loads)	☐	☐	☐	_____
Columns, pilasters, corbels	☐	☐	☐	_____
Diaphragms, horizontal bracing	☐	☐	☐	_____
Walls, vertical bracing	☐	☐	☐	_____
Precast connections	☐	☐	☐	_____
Other_____	☐	☐	☐	_____
Nonstructural hazards:				
Parapets, ornamentation	☐	☐	☐	_____
Cladding, glazing	☐	☐	☐	_____
Ceilings, light fixtures	☐	☐	☐	_____
Interior walls, partitions	☐	☐	☐	_____
Elevators	☐	☐	☐	_____
Stairs, exits	☐	☐	☐	_____
Electric, gas	☐	☐	☐	_____
Other_____	☐	☐	☐	_____
Geotechnical hazards:				
Slope failure, debris	☐	☐	☐	_____
Ground movement, fissures	☐	☐	☐	_____
Other_____	☐	☐	☐	_____

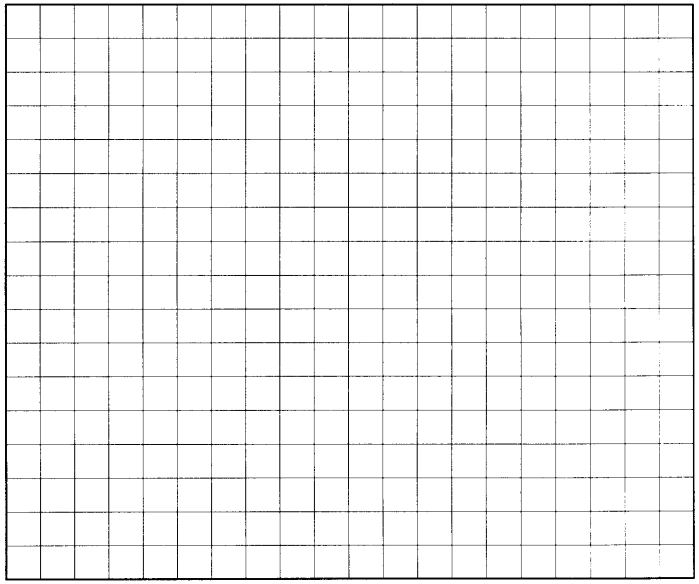
General Comments: _____

_____

Detailed Evaluation Page 1

Building name: _____ Inspector ID: _____

Sketch (optional)
Provide a sketch of the building or damaged portions. Indicate damage points.



Estimated Building Damage
If requested by the jurisdiction, estimate building damage (repair cost ÷ replacement cost, excluding contents).

- ☐ None
- ☐ 0–1%
- ☐ 1–10%
- ☐ 10–30%
- ☐ 30–60%
- ☐ 60–100%
- ☐ 100%

Posting
If there is an existing posting from a previous evaluation, check the appropriate box.

Previous posting: ☐ INSPECTED ☐ RESTRICTED USE ☐ UNSAFE Inspector ID: _____ Date: _____

If necessary, revise the posting based on the new evaluation and team judgment. *Severe* conditions endangering the overall building are grounds for an Unsafe posting. Local *Severe* and overall *Moderate* conditions may allow a Restricted Use posting. Indicate the current posting below and at the top of page one.

☐ **INSPECTED** (Green placard) ☐ **RESTRICTED USE** (Yellow placard) ☐ **UNSAFE** (Red placard)

Record any use and entry restrictions exactly as written on placard: _____

_____

_____

Further Actions Check the boxes below only if further actions are needed.

☐ Barricades needed in the following areas: _____

_____

☐ Engineering Evaluation recommended: ☐ Structural ☐ Geotechnical ☐ Other: _____

☐ Other recommendations: _____

_____

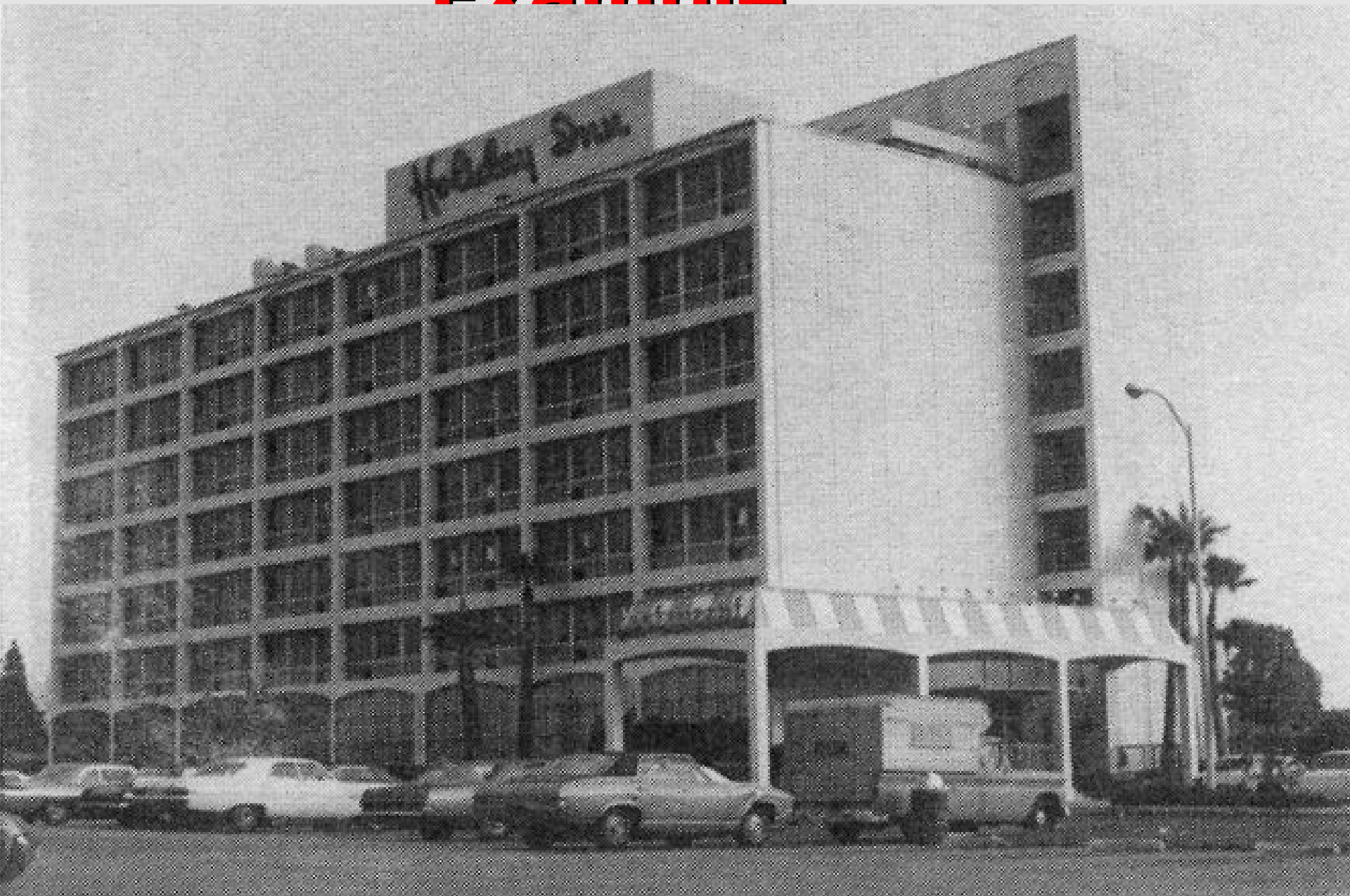
_____

Comments: _____

_____

Detailed Evaluation Page 2

Detailed Evaluation Example



Example Detailed Evaluation - Page 1 upper

ATC-20 Detailed Evaluation Safety Assessment Form

Inspection

Inspector ID: #1234

Affiliation: OES VOLUNTEER

Inspection date and time: 2-10-89 10:30 ☒ AM ☐ PM

Final Posting
from page 2

☒ Inspected
☐ Restricted Use
☐ Unsafe

Building Description

Building name: HEARTBREAK HOTEL

Address: 1410 ELVIS WAY
MUSICLAND, CA

Building contact/phone: _____

Number of stories above ground: 7 below ground: 0

Approx. "Footprint area" (square feet): 10,500

Number of residential units: 130

Number of residential units not habitable: 130

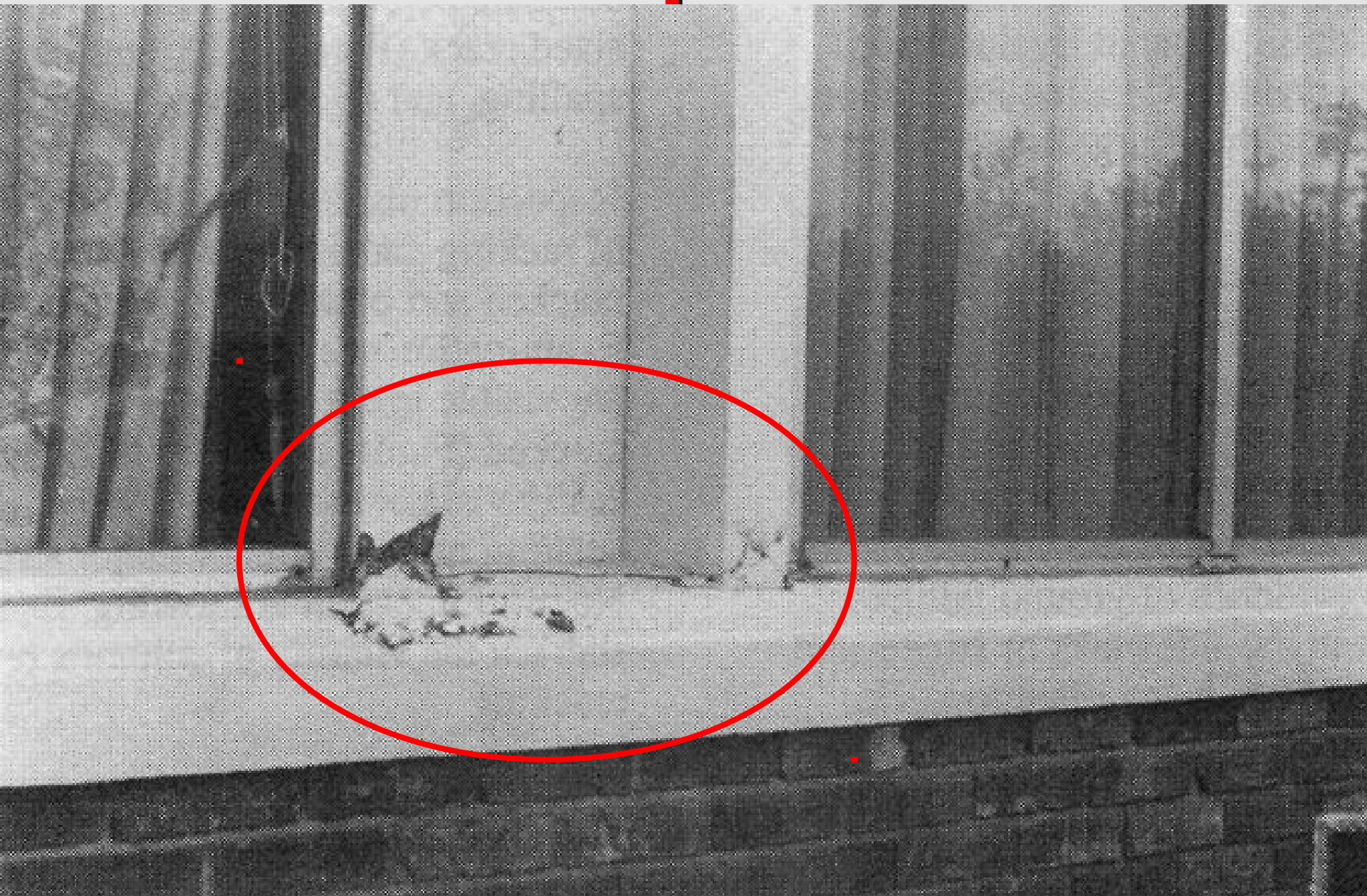
Type of Construction

☐ Wood frame
☐ Steel frame
☐ Tilt-up concrete
☒ Concrete frame
☐ Concrete shear wall
☐ Unreinforced masonry
☐ Reinforced masonry
☐ Other: _____

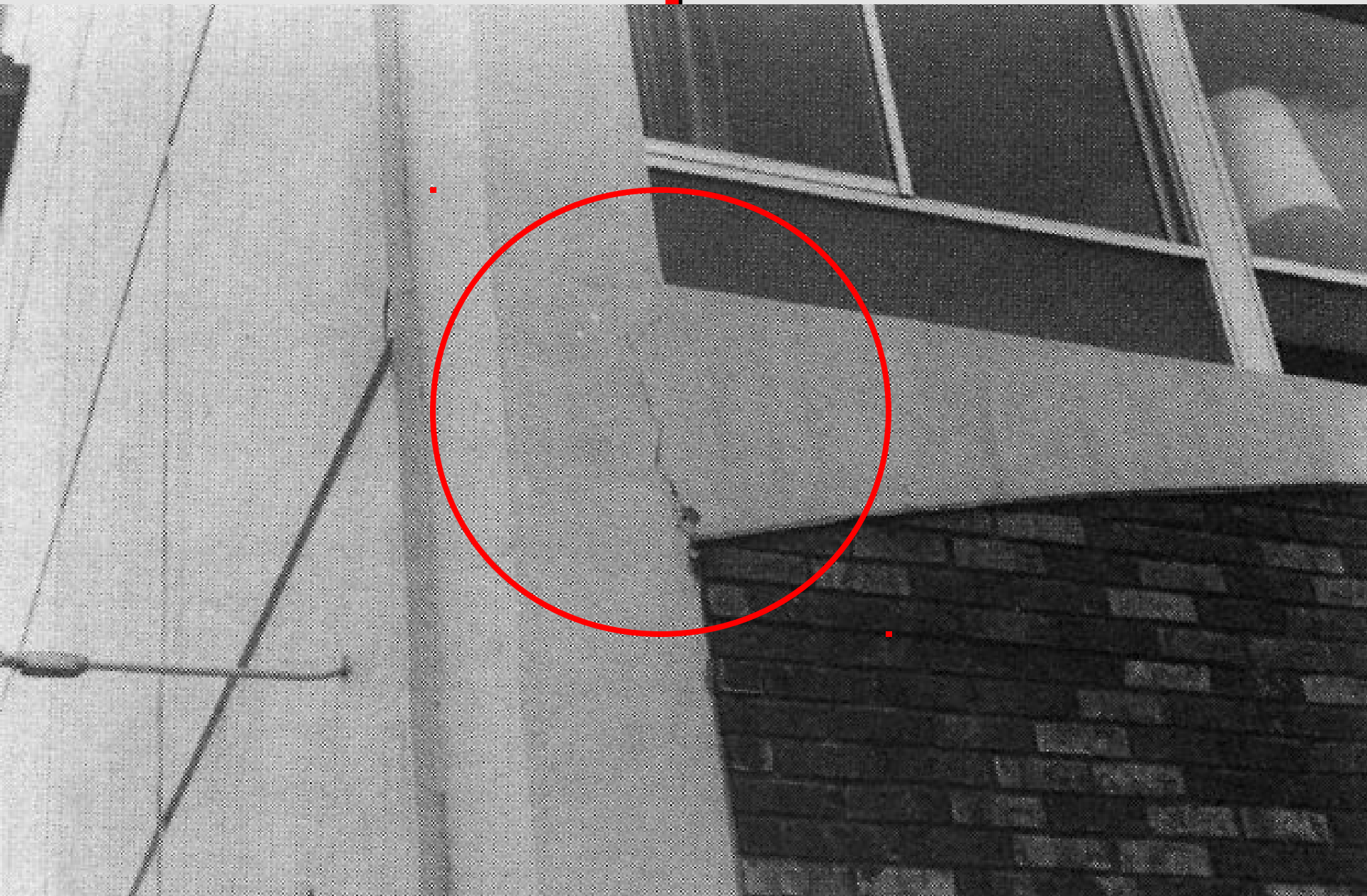
Primary Occupancy

☐ Dwelling
☐ Other residential
☐ Public assembly
☐ Emergency services
☐ Commercial
☐ Offices
☐ Industrial
☐ Government
☐ Historic
☐ School
☐ Other: HOTEL

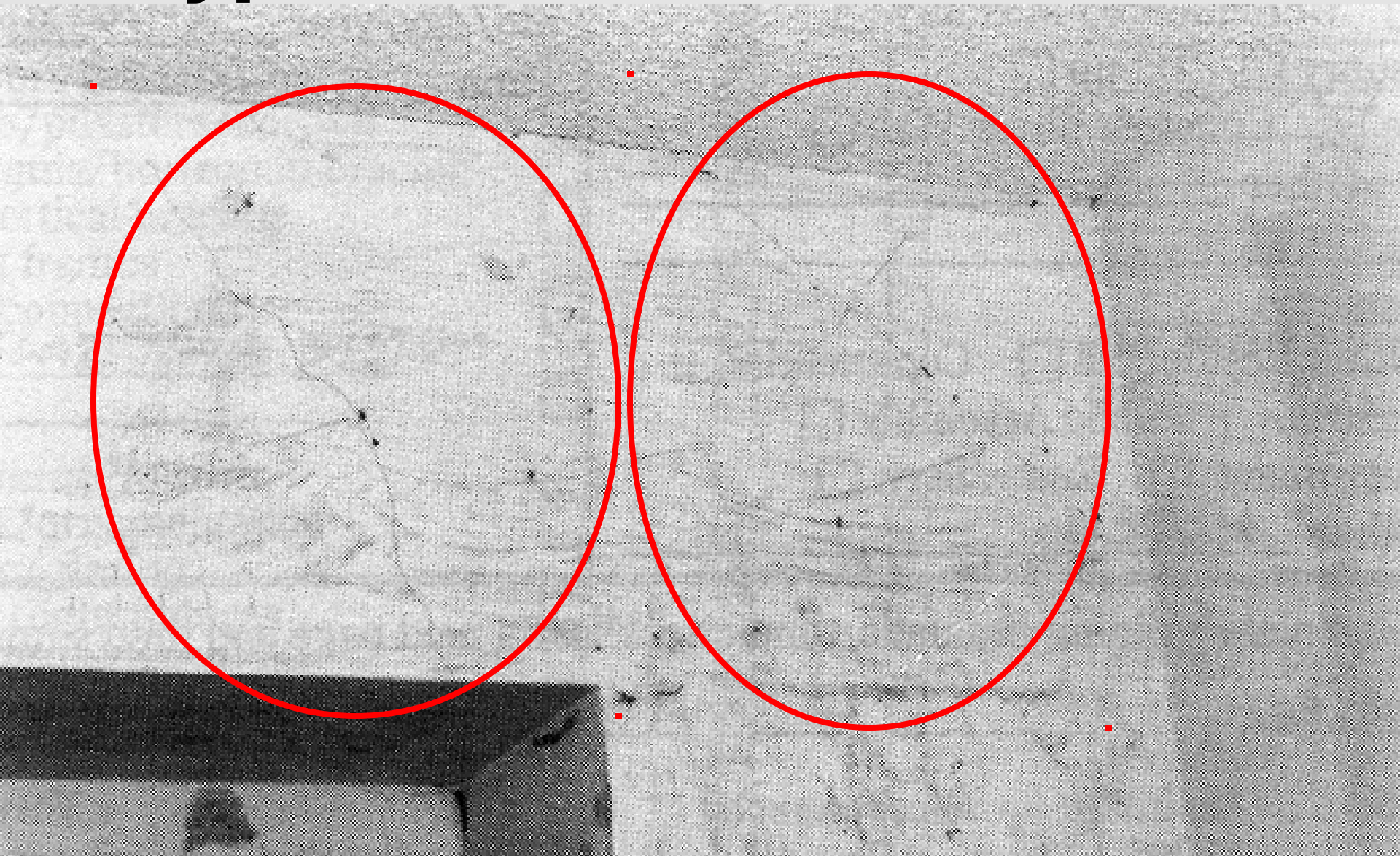
Detailed Evaluation Example



Detailed Evaluation Example



Example
Typical Moment Frame



Evaluation

Investigate the building for the conditions below and check the appropriate column. There is room on the second page for a sketch.

	Minor/None	Moderate	Severe	Comments
Overall hazards:				
Collapse or partial collapse	☒	☐	☐	
Building or story leaning	☒	☐	☐	
Other_____	☐	☐	☐	
Structural hazards:				
Foundations	☒	☐	☐	
Roofs, floors (vertical loads)	☒	☐	☐	
Columns, pilasters, corbels	☒	☐	☐	1/32" CRACKS @ BM/COL JTS
Diaphragms, horizontal bracing	☒	☐	☐	
Walls, vertical bracing	☒	☐	☐	
Precast connections	☐	☐	☐	
Other FLAT SLAB	☒	☐	☐	NO PUNCH SHEAR CRACKS OBSERVED
Nonstructural hazards:				
Parapets, ornamentation	☒	☐	☐	
Cladding, glazing	☒	☐	☐	
Ceilings, light fixtures	☒	☐	☐	
Interior walls, partitions	☒	☐	☐	MINOR WALL CRACKING
Elevators	☒	☐	☐	INSPECTED BY ELEV. CO
Stairs, exits	☒	☐	☐	MINOR CRACKS, USABLE
Electric, gas	☒	☐	☐	NO REPORTED PROBLEM
Other_____	☐	☐	☐	
Geotechnical hazards:				
Slope failure, debris	☒	☐	☐	
Ground movement, fissures	☒	☐	☐	
Other_____	☐	☐	☐	

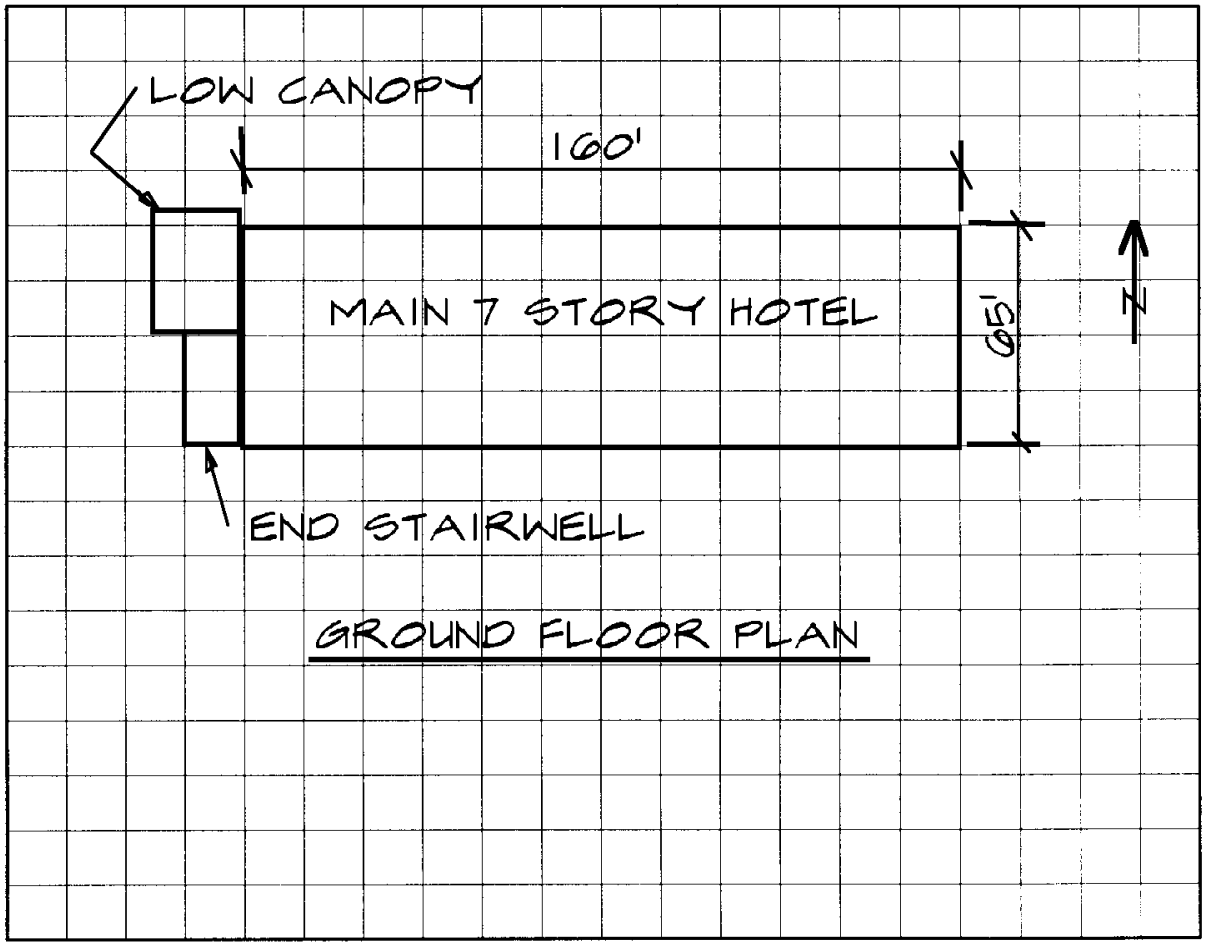
General Comments: NO SIGNIFICANT DAMAGE. LOTS OF SMALL CRACKS IN BEAMS & COLS. NO REBAR EXPOSED. REPAIR NON-STRUCT DAMAGE

Example Detailed Evaluation - Page 2 upper

ATC-20 Detailed Evaluation Safety Assessment Form **Page 2**

Building name: HEARTBREAK HOTEL Inspector ID: #1234, OES VOLUNTEER

Sketch (optional)
Provide a sketch of the building or damaged portions. Indicate damage points.



Estimated Building Damage
If requested by the jurisdiction, estimate building damage (repair cost ÷ replacement cost, excluding contents).

- ☐ None
- ☐ 0–1%
- ☒ 1–10%
- ☐ 10–30%
- ☐ 30–60%
- ☐ 60–100%
- ☐ 100%

Example Detailed Evaluation - Page 2 lower

Posting

If there is an existing posting from a previous evaluation, check the appropriate box. NONE

Previous posting: ☐ INSPECTED ☐ RESTRICTED USE ☐ UNSAFE Inspector ID: _____ Date: _____

If necessary, revise the posting based on the new evaluation and team judgment. *Severe* conditions endangering the overall building are grounds for an Unsafe posting. Local *Severe* and overall *Moderate* conditions may allow a Restricted Use posting. Indicate the current posting below and at the top of page one.

☒ **INSPECTED** (Green placard) ☐ **RESTRICTED USE** (Yellow placard) ☐ **UNSAFE** (Red placard)

Record any use and entry restrictions exactly as written on placard: NONE

Further Actions Check the boxes below only if further actions are needed.

☐ Barricades needed in the following areas: NONE

☐ Engineering Evaluation recommended: ☐ Structural ☐ Geotechnical ☐ Other: _____

☐ Other recommendations: NONE

Comments: NO SIGNIFICANT STRUCTURAL DAMAGE. HOTEL COULD BE OCCUPIED PRIOR TO REPAIR OF NON-STRUCTURAL DAMAGE

DETAILED EVALUATION OF ESSENTIAL FACILITY

- Health Care Facilities
- Police and Fire Stations
- Jails and Detention Centers
- Emergency Operations Centers
- High Occupancy Shelters

Nantou Co Fire Station #1 Concrete Frame w/URM

ATC-20 Fixed Equipment Checklist

FACILITY:
Name: _____
_____
Address: _____
_____
_____
_____

INSPECTOR:
Inspector ID _____
Affiliation _____

INSPECTION DATE:
Mo/day/year _____
Time _____ am pm

CHECKLIST:

General Items:	*No*	Equipment Damaged: *Yes Operable*	*Yes Inoperable*	*Comments*
Main boilers	☐	☐	☐	_____
Chillers	☐	☐	☐	_____
Emergency generators	☐	☐	☐	_____
Fuel tanks	☐	☐	☐	_____
Battery racks	☐	☐	☐	_____
Fire pumps	☐	☐	☐	_____
On-site water storage	☐	☐	☐	_____
Communications Equipment	☐	☐	☐	_____
Main transformers	☐	☐	☐	_____
Main electrical panels	☐	☐	☐	_____
Elevators (traction)	☐	☐	☐	_____
Other fixed equipment:				
_____	☐	☐	☐	_____
_____	☐	☐	☐	_____
_____	☐	☐	☐	_____
_____	☐	☐	☐	_____
_____	☐	☐	☐	_____

Special Concerns for Hospitals and Other Health Care Facilities:

Radiation equipment	☐	☐	☐	_____
Toxic chemical storage:				
_____	☐	☐	☐	_____
_____	☐	☐	☐	_____
_____	☐	☐	☐	_____
Liquid oxygen tanks	☐	☐	☐	_____
Other: _____	☐	☐	☐	_____
_____	☐	☐	☐	_____

Recommendations/Comments: _____
_____
_____
_____

Fixed Equipment Checklist

Important for Essential Facilities

STRUCTURAL BUILDING TYPES

STRUCTURAL BUILDING TYPES - ATC-21-1

W	WOOD BUILDINGS OF ALL TYPES
S1	STEEL MOMENT RESISTING FRAMES
S2	BRACED STEEL FRAMES
S3	LIGHT METAL BUILDINGS
S4	STEEL FRAMES W/CAST IN PLACE CONC WALLS
C1	CONCRETE MOMENT RESISTING FRAMES
C2	CONCRETE SHEAR WALL BUILDINGS
C3/S5	CONCRETE/STEEL FRAME W/URM INFILL WALLS
TU	TILT-UP CONCRETE WALL BUILDING BUILDINGS
PC2	PRECAST CONCRETE FRAME BUILDINGS
RM	REINFORCED MASONRY BUILDINGS
URM	UNREINFORCED MASONRY BUILDING

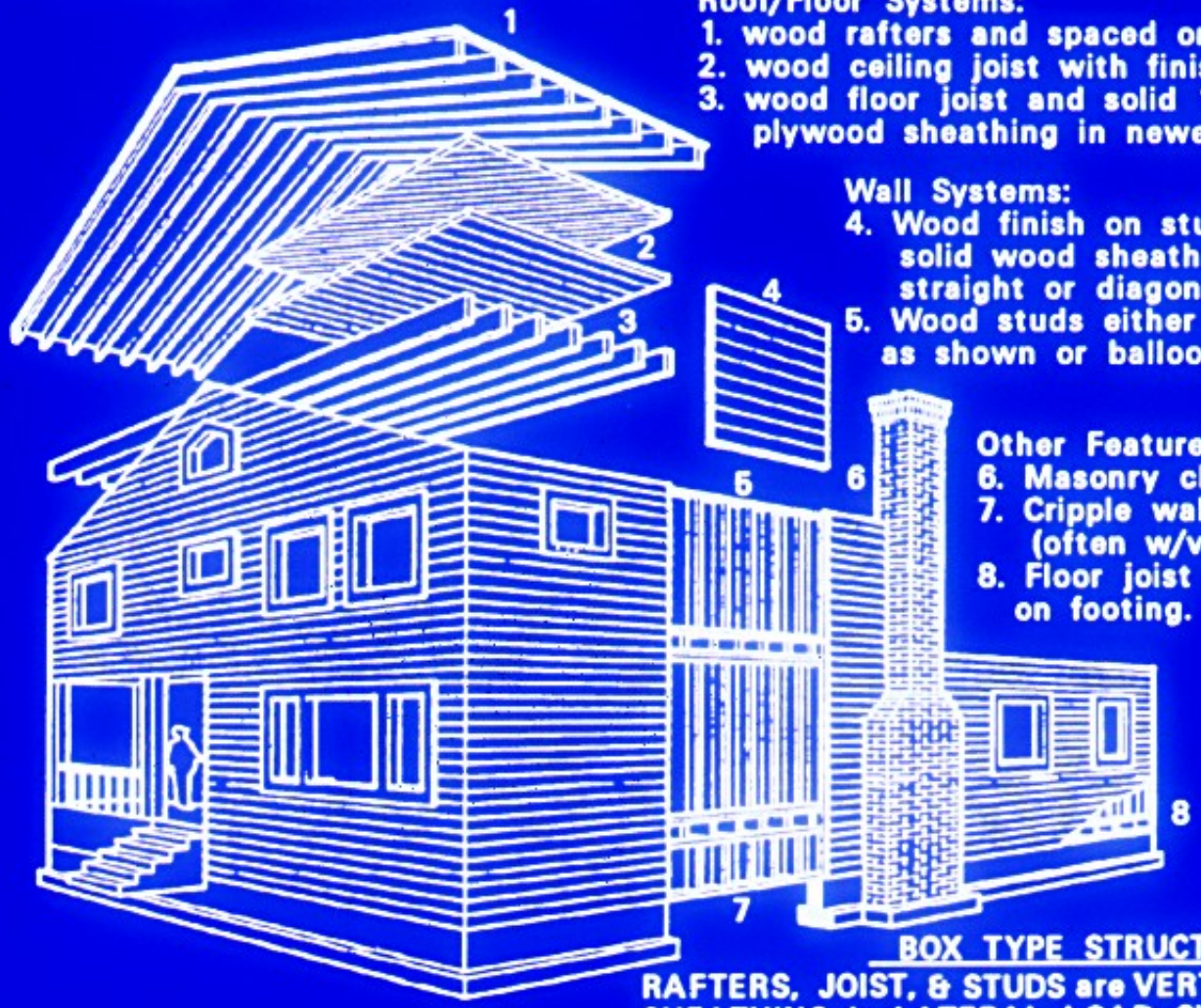
PROBLEM BUILDINGS

W	1 TO 3 STORY HOUSES & 2 TO 4 STORY APARTMENTS (ESPECIALLY PRE 1940)
URM	1 TO 8 STORY (MOST LESS THAN 3 STORY) ALSO STEEL & CONC FRAMES W/URM INFILL
C1/C3	PRE 1971 BLDGS (ESPECIALLY PRE 1940)
PC2/TU	FACTORY BUILT PRECAST & TILT-UP WALL (OLDER POORLY CONNECTED BLDGS)
S2	TALLER FRAMES WHERE COLUMN CAPACITY DOESN'T EXCEED CAPACITY OF DIAG BRACES
OTHERS	BUILDINGS WITH IRREGULARITIES SOFT FIRST & OTHER STORY BLDGS OPEN FRONT & CORNER BUILDINGS

WOOD FRAME CONSTRUCTION

- Chapter 5, ATC 20-1
- Single Family Residential
- Multi-unit Residential & Commercial

WOOD HOUSES - W



Roof/Floor Systems:

1. wood rafters and spaced or solid sheathing
2. wood ceiling joist with finish
3. wood floor joist and solid 1x sheathing or plywood sheathing in newer houses

Wall Systems:

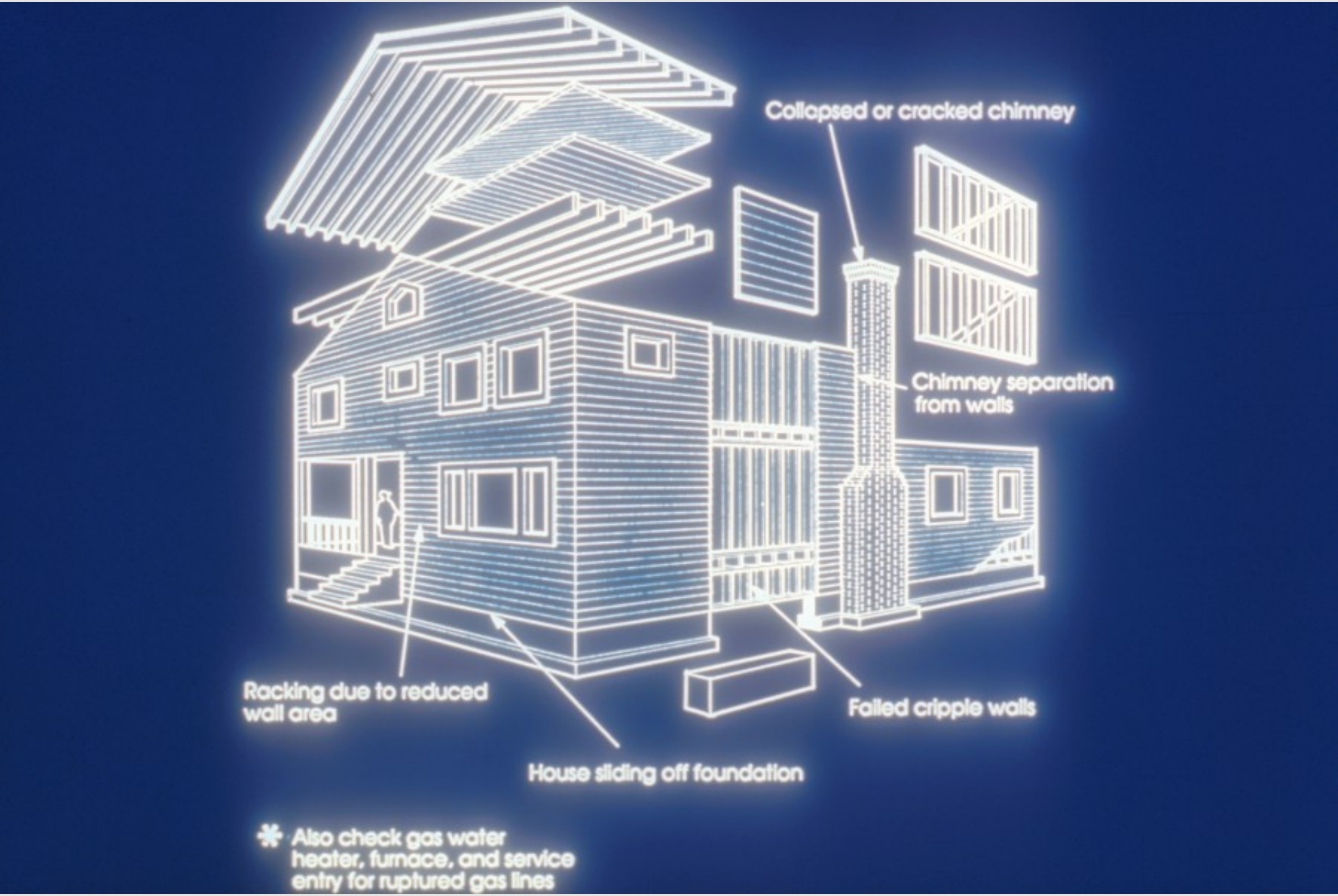
4. Wood finish on studs or Stucco on solid wood sheathing: plywood, 1x straight or diagonal boards.
5. Wood studs either platform framed as shown or balloon framed

Other Features:

6. Masonry chimney
7. Cripple wall below 1st floor (often w/vent holes)
8. Floor joist may bear directly on footing.

BOX TYPE STRUCTURE

RAFTERS, JOIST, & STUDS are VERTICAL LOAD SYS.
SHEATHING is LATERAL LOAD SYSTEM


Collapsed or cracked chimney
Chimney separation from walls
Racking due to reduced wall area
Failed cripple walls
House sliding off foundation
* Also check gas water heater, furnace, and service entry for ruptured gas lines

INSPECTION & POSTING OF WOOD FRAME STRUCTURES

- **OVERALL DAMAGE: Collapse, partial collapse, separation (UNSAFE)**
- **ROOF / FLOOR: Displaced from wall (UNSAFE)**
- **WALLS: Building or story leaning > 2” per story (UNSAFE); crippled wall failure (UNSAFE)**

INSPECTION & POSTING OF WOOD FRAME STRUCTURES (CONT'D)

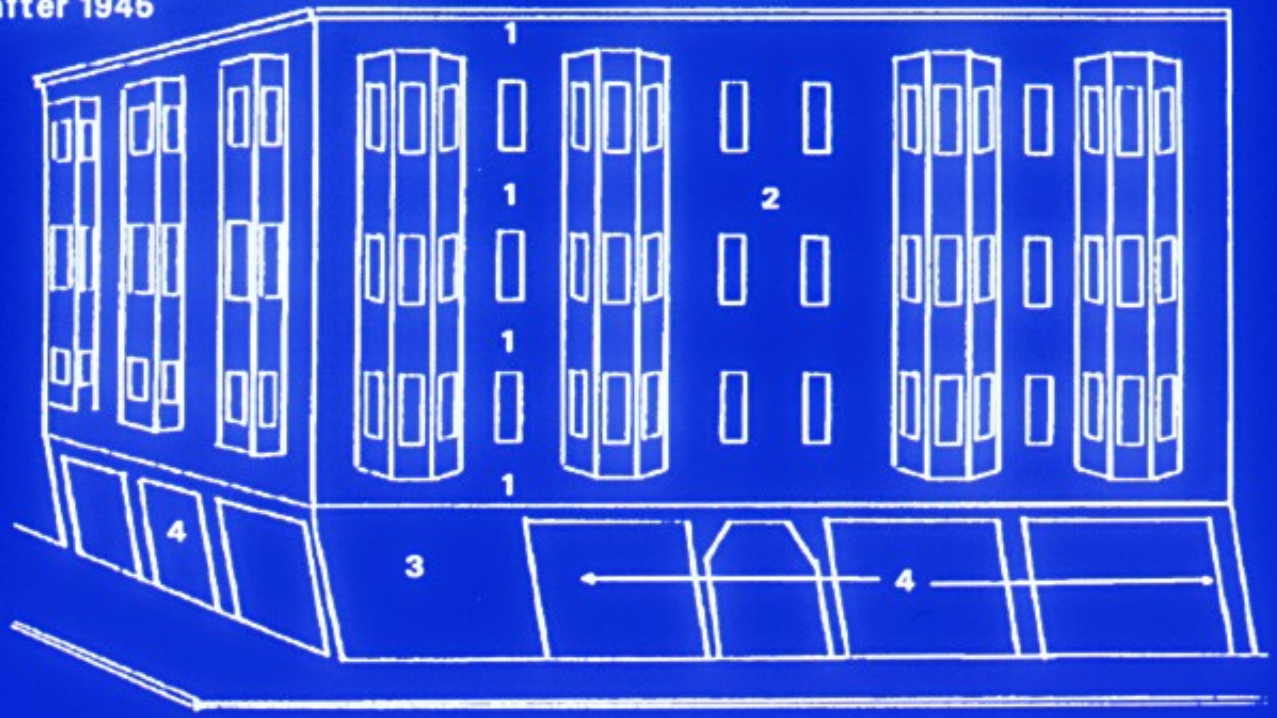
- **FOUNDATIONS: Building off foundation (UNSAFE); Fractured foundation (UNSAFE); Broken or displaced post (UNSAFE)**
- **OTHER: Gas leak (UNSAFE); Falling hazard present, ie chimney, balcony, porch, tile, etc (AREA UNSAFE)**

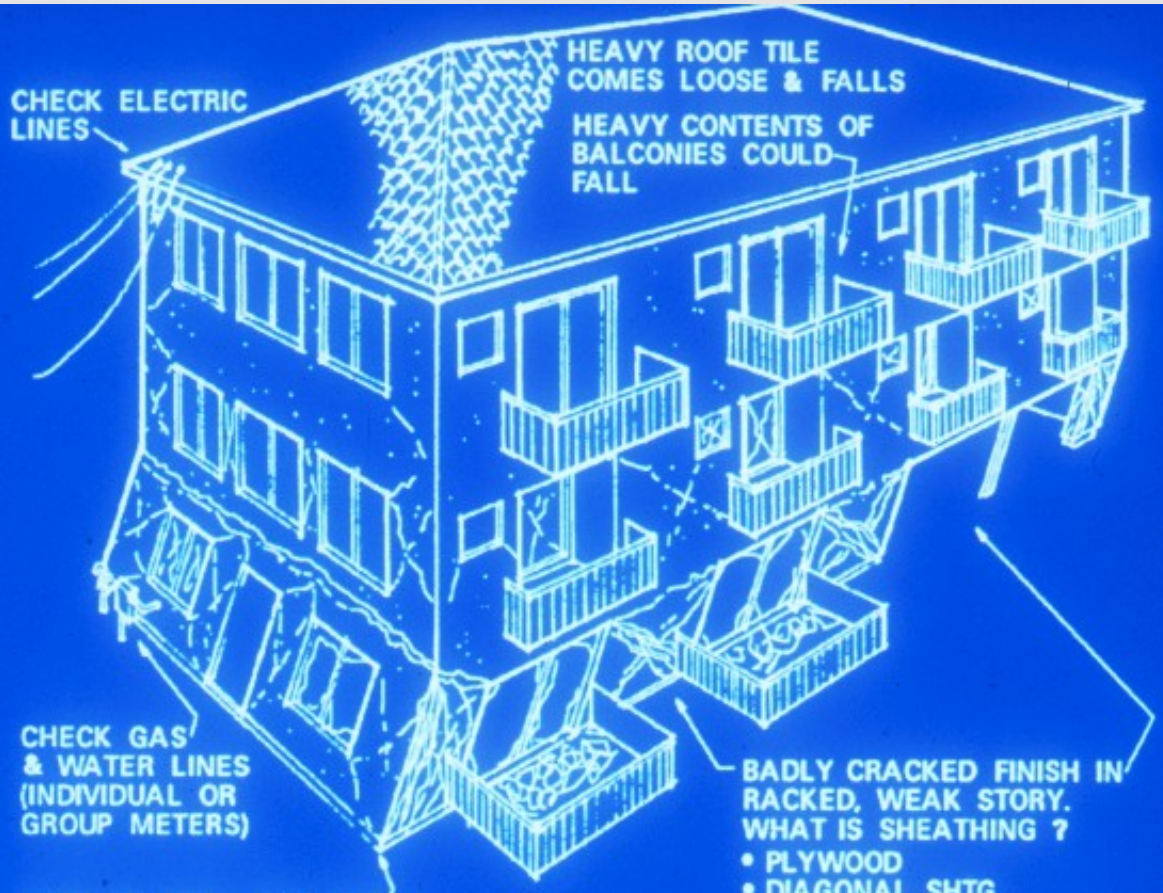
After veneer is damage, Is House Unsafe?

Z85 CGD

WOOD FRAME APARTMENT BUILDINGS

1. 2x wood joist at roof/floors with 1x wood sheathing or plywood (post 1945)
2. Wood studs, platform framed with wood sheathing:
   1x horizontal - pre 1935
   1x diagonal - pre 1945
   Plywood, Gypsum, or wire after 1945
3. Walls may have masonry veneer especially in first story
4. First story garage openings create a weak/soft story. This can be overcome by using properly designed shearwalls or by changing the garage to a concrete structure with strong shearwalls.




HEAVY ROOF TILE COMES LOOSE & FALLS
HEAVY CONTENTS OF BALCONIES COULD FALL
CHECK ELECTRIC LINES
CHECK GAS & WATER LINES (INDIVIDUAL OR GROUP METERS)
BASE OF WALL MAY NOT REMAIN ANCHORED TO SOLE
• IF WALLS HAVE MASONRY VENEER LETHAL FALLING HAZARD EXISTS
• LOOK-OUT FOR BROKEN GLASS
BADLY CRACKED FINISH IN RACKED, WEAK STORY. WHAT IS SHEATHING ?
• PLYWOOD
• DIAGONAL SHTG
• STUCCO ONLY
• STUCCO OVER PLYWOOD
• STUCCO OVER GYPSUM BOARD
• BRITTLE SYSTEM CAN COLLAPSE IN AFTERSHOCK
• PLYWOOD OR DIAGONAL SHTG SYSTEM WILL DEPEND ON HOW BADLY NAILS HAVE PULLED-OUT OR PULLED-THRU

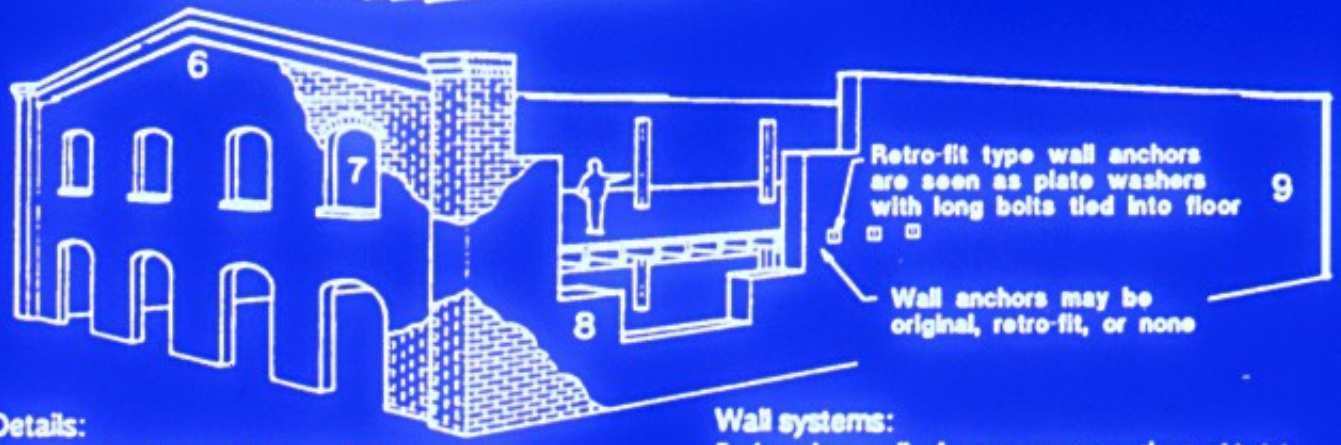
MASONRY CONSTRUCTION

- Chapter 6, ATC 20-1
- Unreinforced brick masonry bearing wall buildings
- Unreinforced concrete block masonry bearing wall buildings
- Steel frame with infill buildings
- Reinforced masonry buildings

UNREINFORCED MASONRY URM

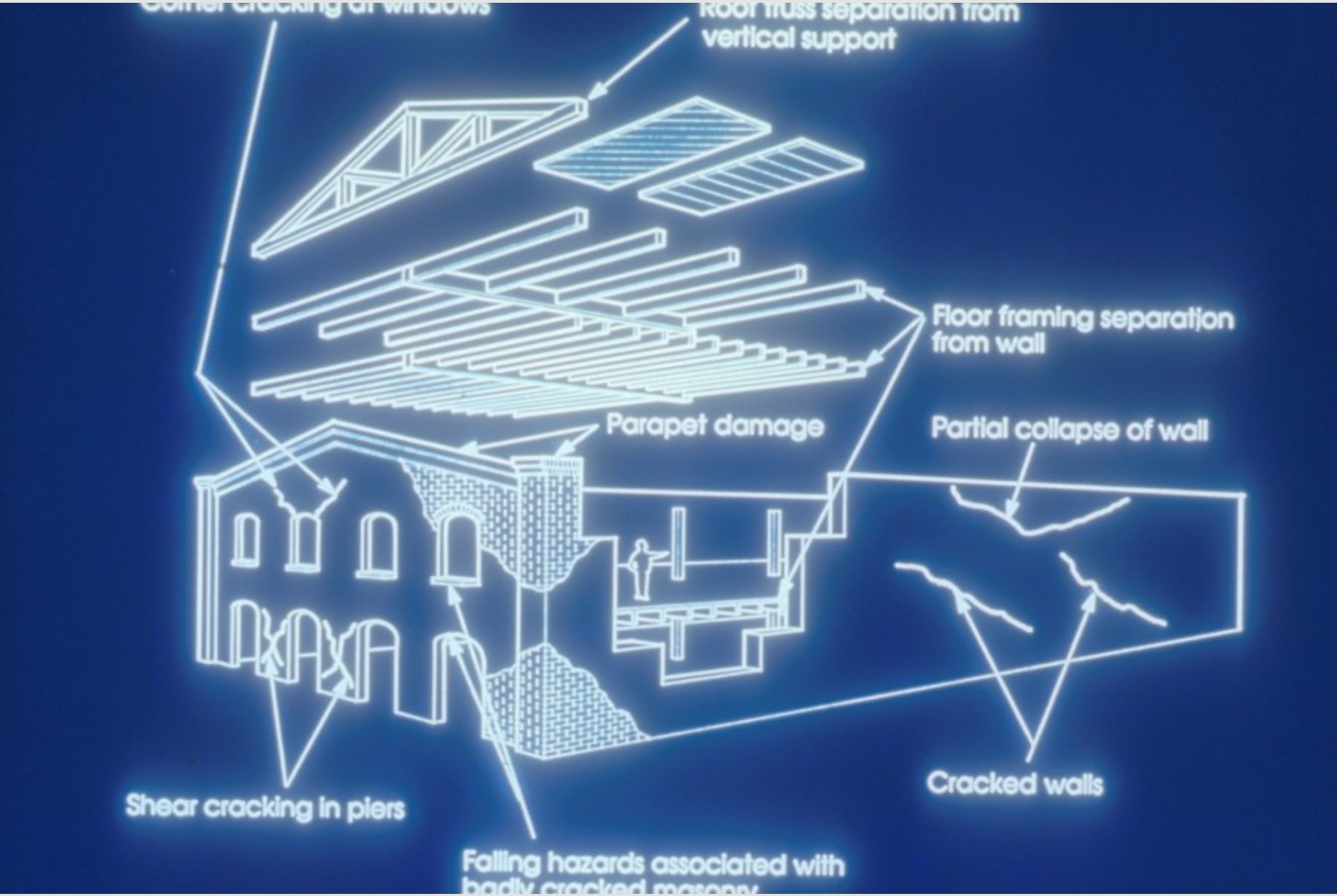
Roof/floor span systems:
1. wood post and beam (heavy timber)
2. wood post, beam, and joist (mill construction)
3. wood truss-- pitch and curve

Roof/floor diaphragms:
4. diagonal sheathing
5. straight sheathing

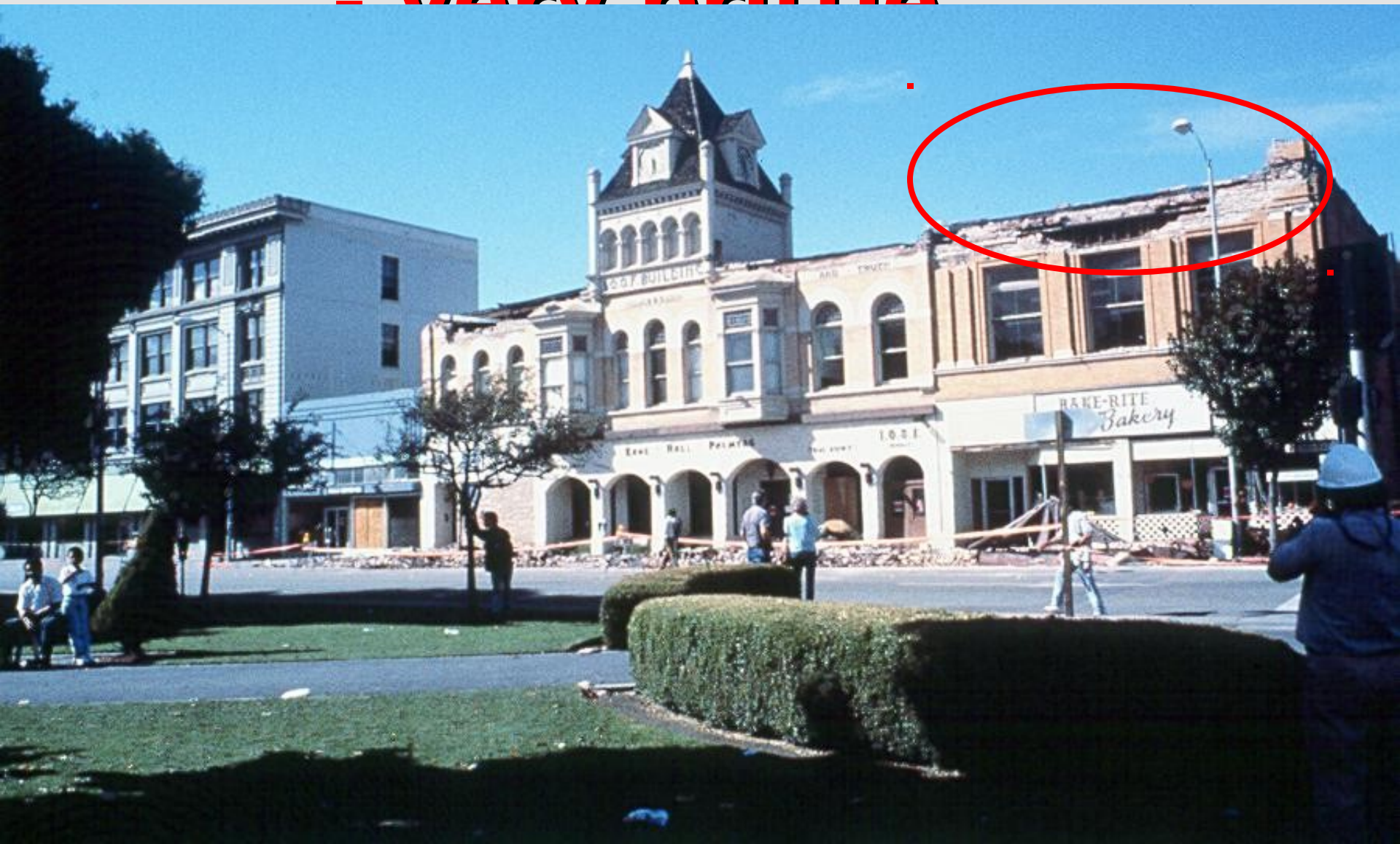

6
7
8
Retro-fit type wall anchors are seen as plate washers with long bolts tied into floor
9
Wall anchors may be original, retro-fit, or none

Details:
6. typical unbraced parapet and cornice
7. flat arch window openings

Wall systems:
8. bearing wall-- four or more wythes of brick
9. typical long solid party wall


Roof truss separation from vertical support
Floor framing separation from wall
Parapet damage
Partial collapse of wall
Cracked walls
Shear cracking in piers
Falling hazards associated with

Typical URM damage, need to be conservative - very brittle



URM cracks in seismically upgraded building Good Performance, but now needs to be Posted UNSAFE

Unreinforced CMU - no-brainer but what if only hairline cracks?

URM with Steel Frame

Common Type of older office buildings

Dangerous falling hazards

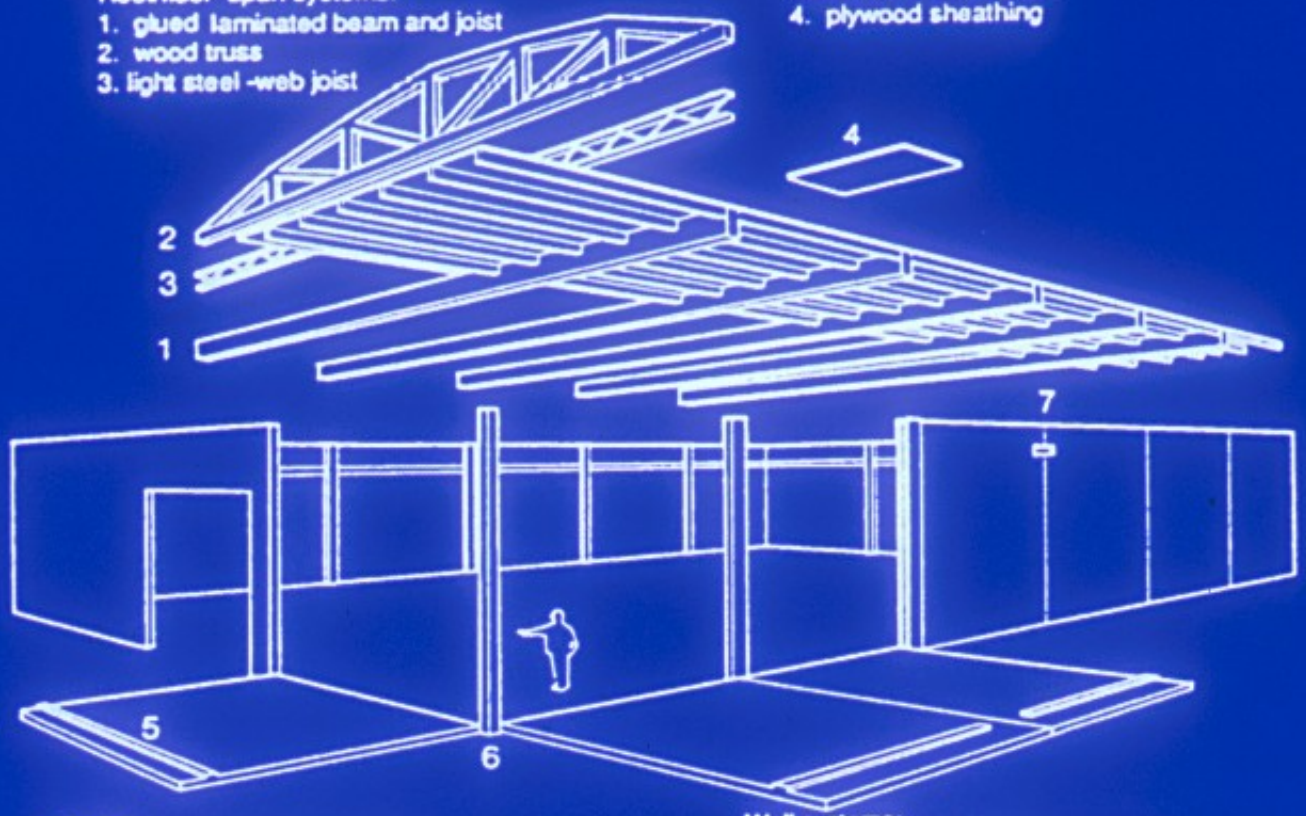
TILT UP CONSTRUCTION

- Chapter 7, ATC 20-1
- From 1 to 4 story buildings
  - mostly 1 & 2 story
  - most walls 20ft and less
- Wall Anchorage
- Roof interconnection
- Wall shear cracking

TILT-UP CONCRETE WALL BUILDING

Roof/floor span systems:
1. glued laminated beam and joist
2. wood truss
3. light steel -web joist

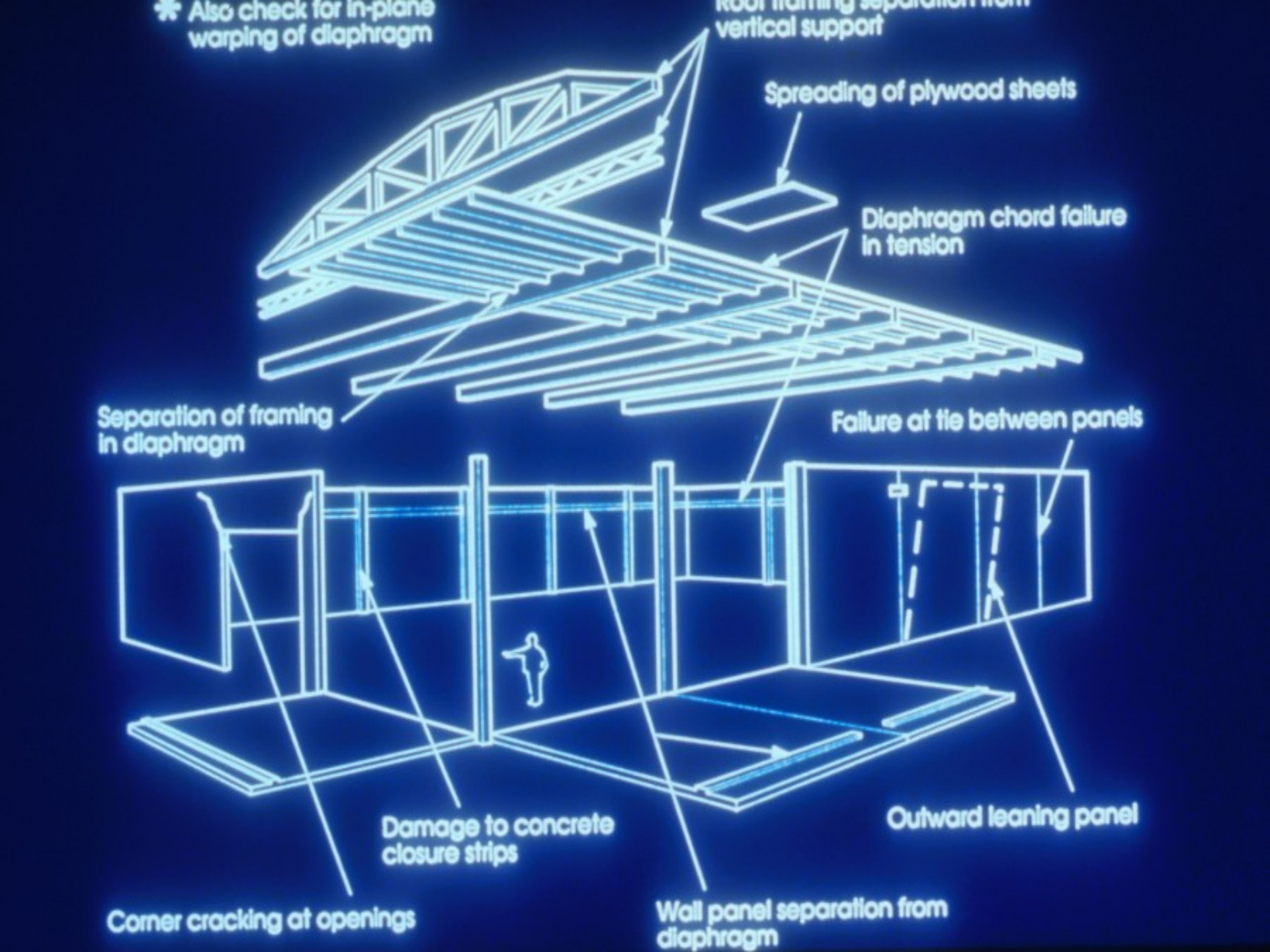
Roof/floor diaphragms:
4. plywood sheathing

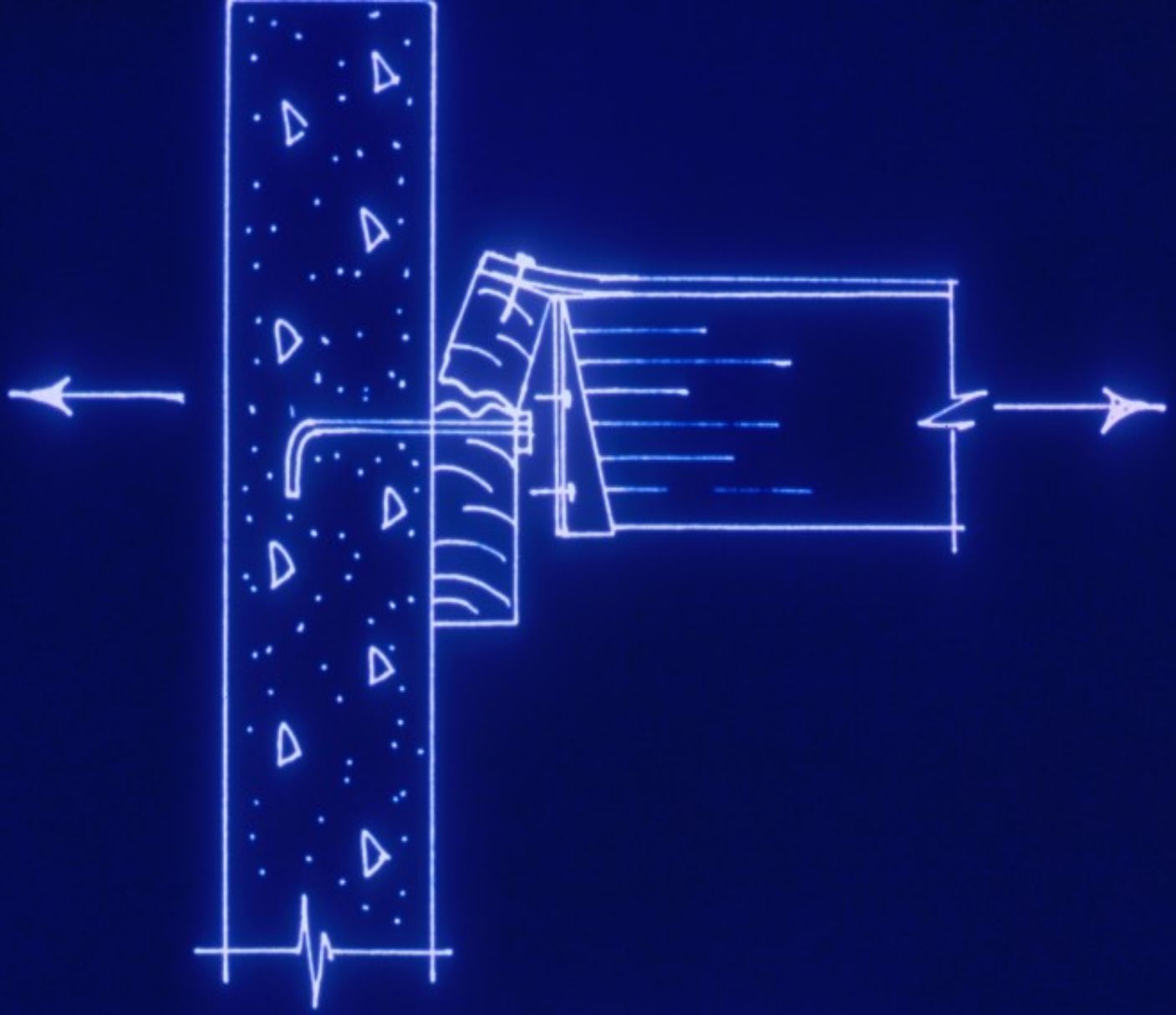


Details:
5. anchor bolted wooden ledger for roof/floor support

Wall systems:
6. cast-in-place columns– square, "T" shape, and "H" shape
7. welded steel plate type panel connection

ONE STORY TILT-UP BUILDING (MAY ALSO BE 2 OR 3 STORY)


* Also check for in-plane warping of diaphragm
Roof framing separation from vertical support
Spreading of plywood sheets
Diaphragm chord failure in tension
Separation of framing in diaphragm
Failure at tie between panels
Damage to concrete closure strips
Outward leaning panel
Corner cracking at openings
Wall panel separation from diaphragm



CROSS-GRAIN LEDGER FRACTURE
AT TILT-UP ROOF-TO-WALL CONNECTION

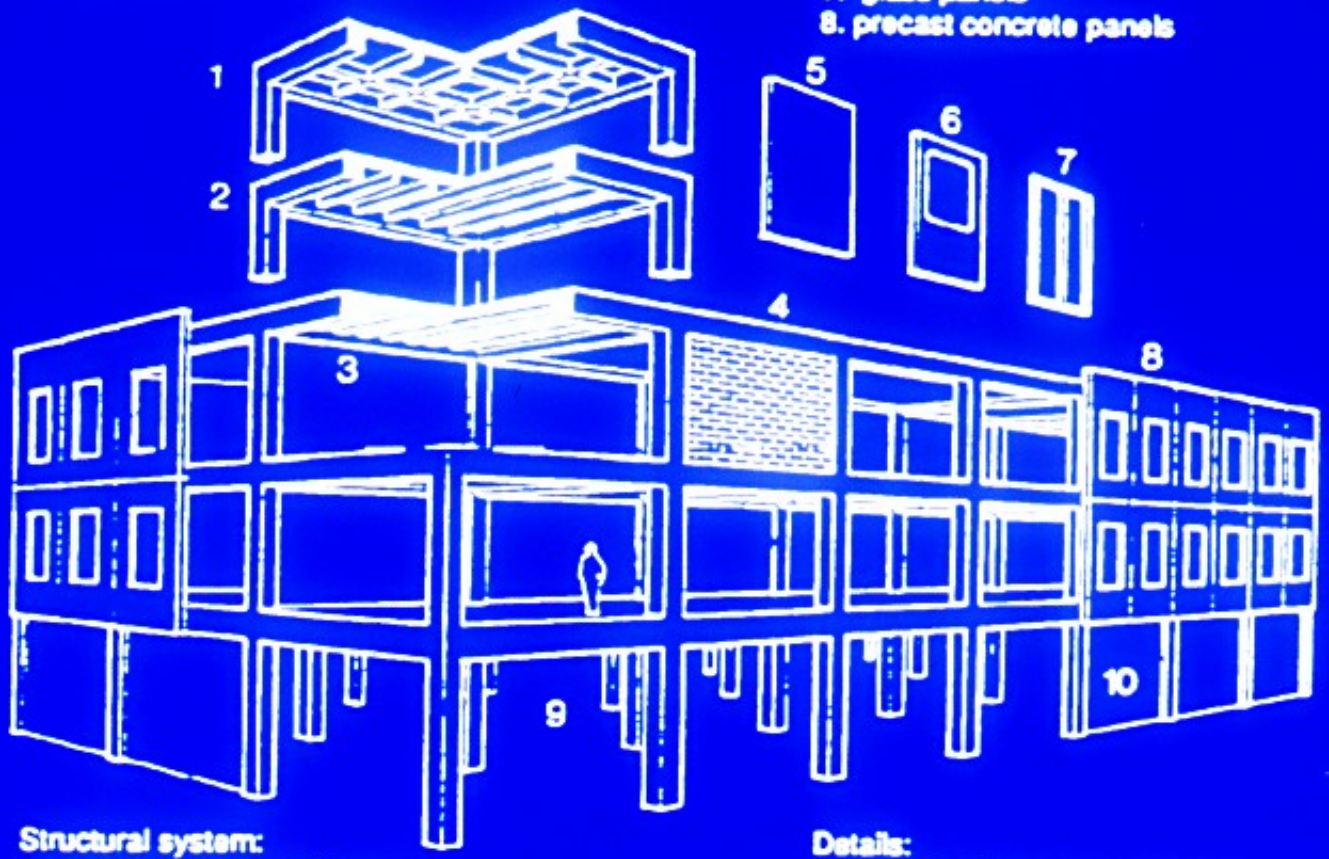
CONCRETE CONSTRUCTION

- Chapter 8, ATC 20-1
- Structural walls or Frames
- Cast in Place or Precast
- Combinations of above
- Concrete Frame w/URM infill

CONCRETE MOMENT RESISTING FRAME C1

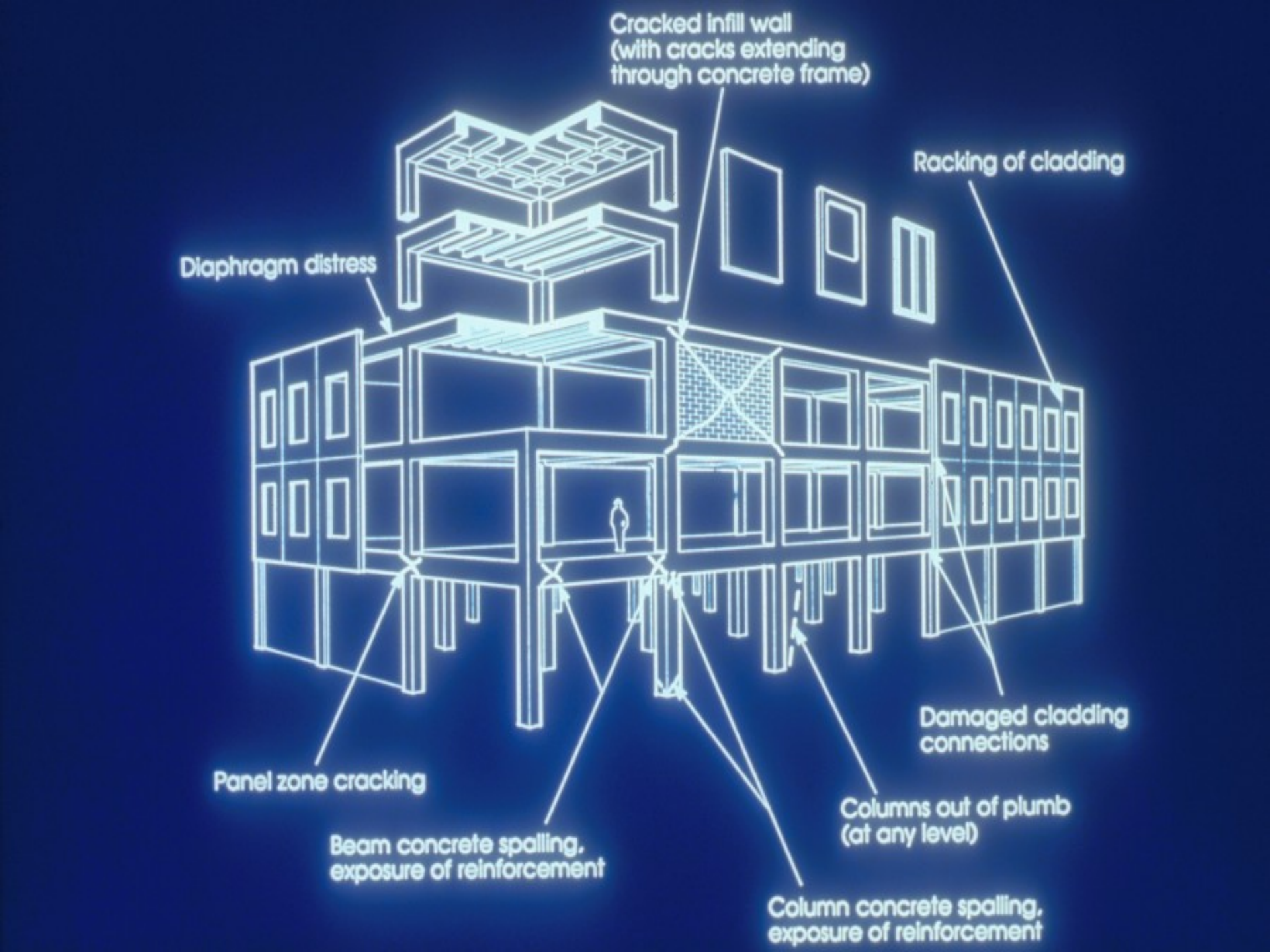
Roof/floor diaphragms:
1. concrete waffle slab
2. concrete joist and slab
3. steel decking with concrete topping

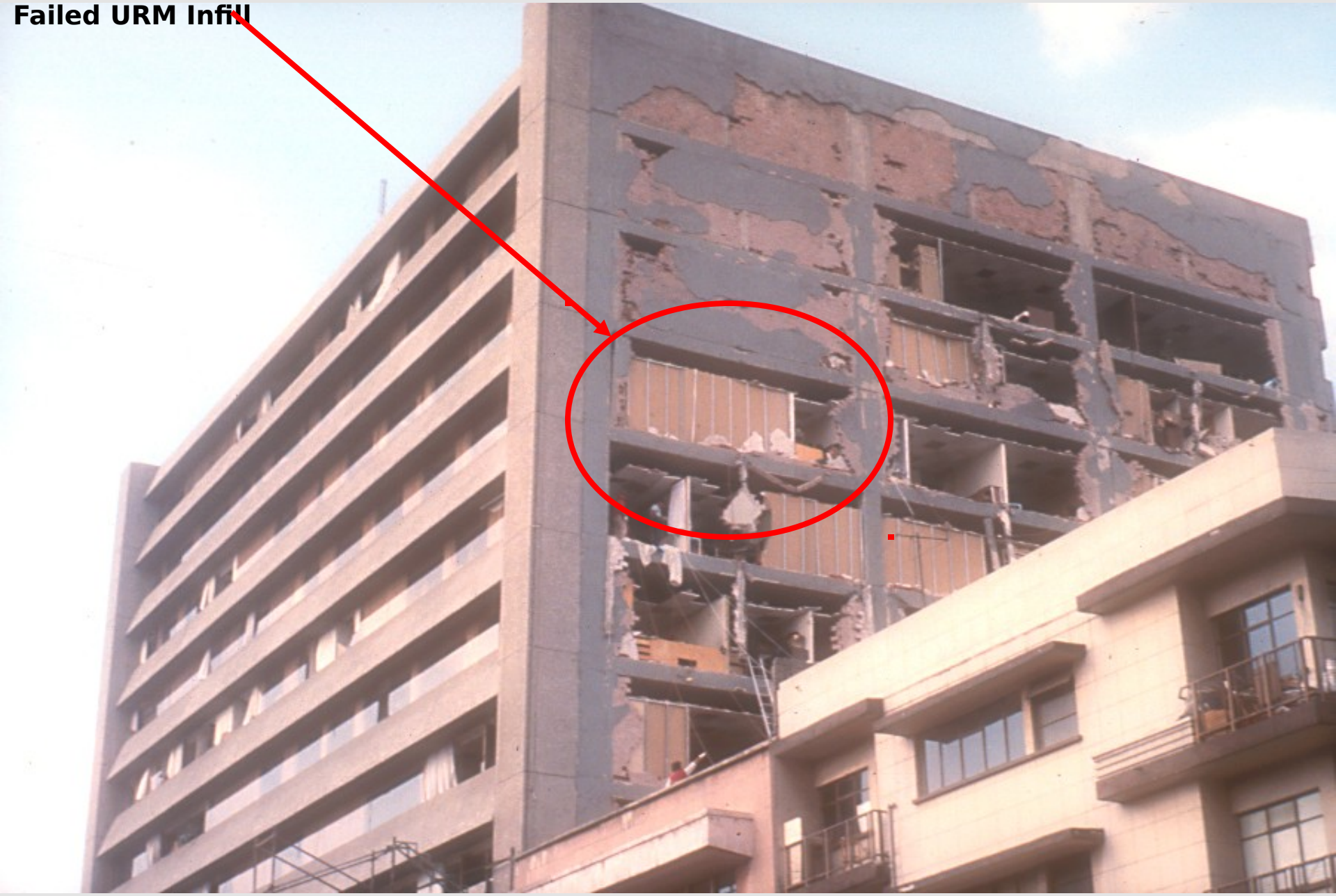
Curtain wall/ non-structural infill:
4. masonry infill walls
5. stone panels
6. metal skin panels
7. glass panels
8. precast concrete panels



Structural system:
9. distributed concrete frame

Details:
10. typical tall first floor (soft story)

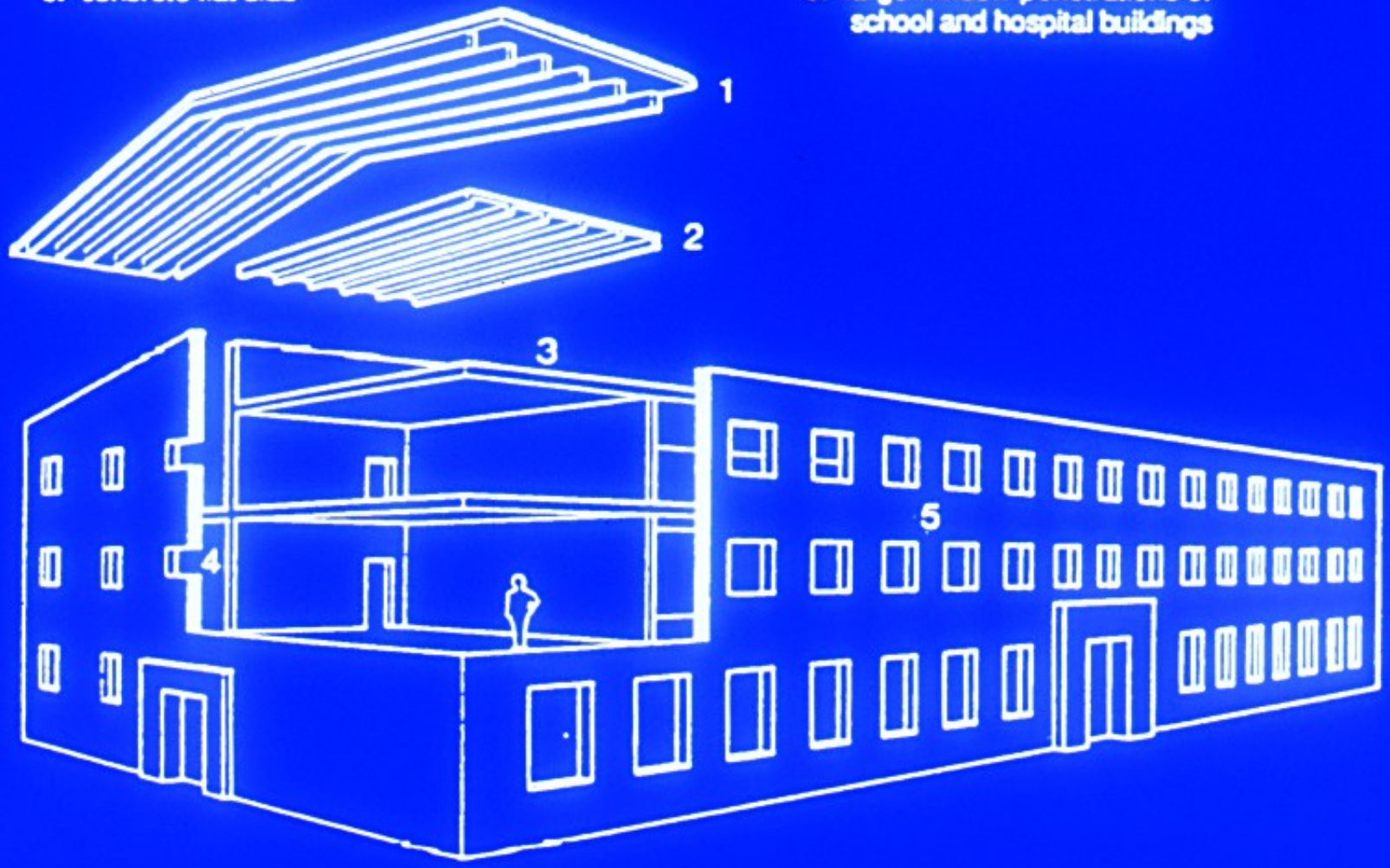

Cracked infill wall
(with cracks extending
through concrete frame)
Racking of cladding
Diaphragm distress
Damaged cladding
connections
Panel zone cracking
Columns out of plumb
(at any level)
Beam concrete spalling,
exposure of reinforcement
Column concrete spalling,
exposure of reinforcement

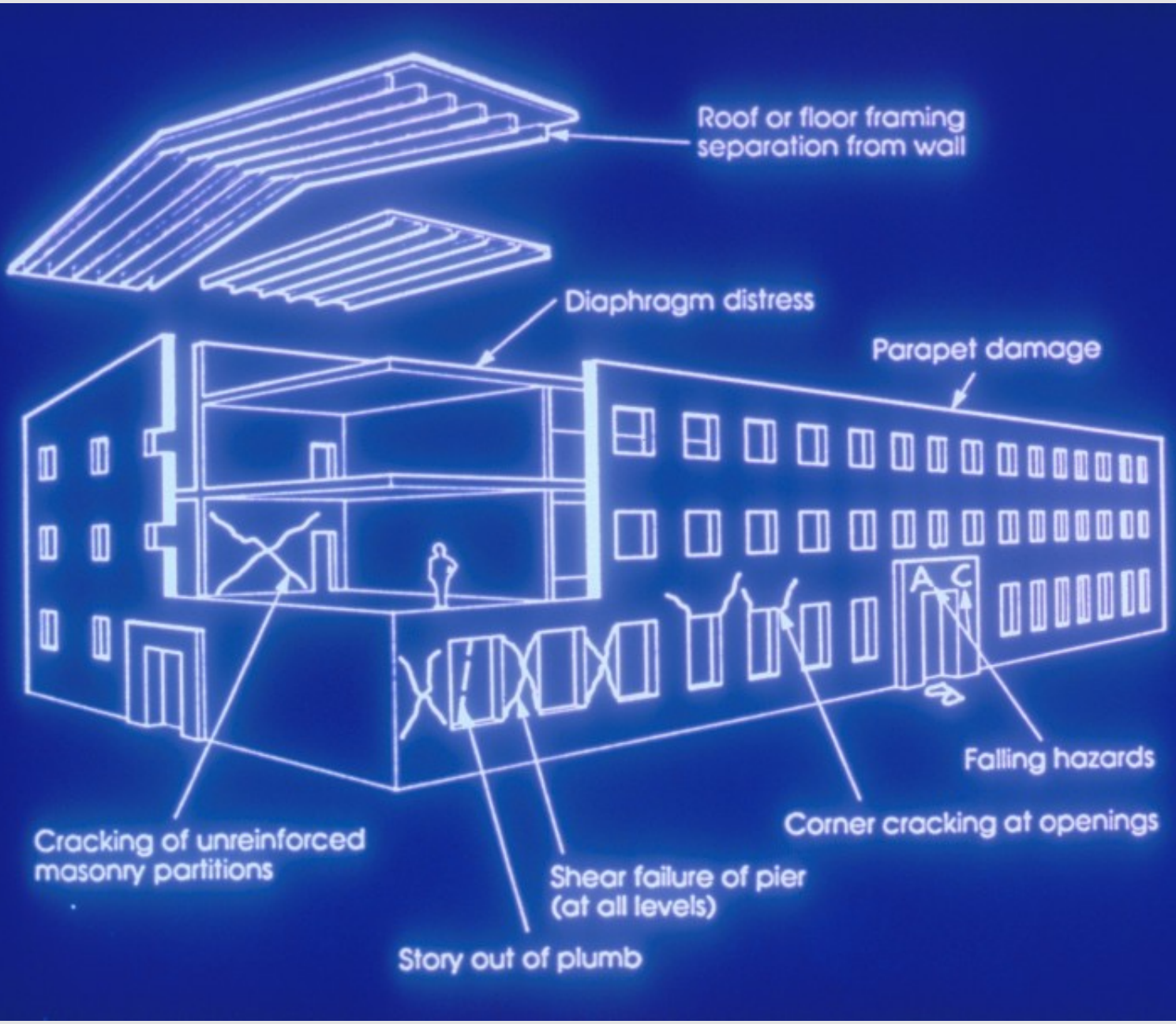

Failed URM Infill

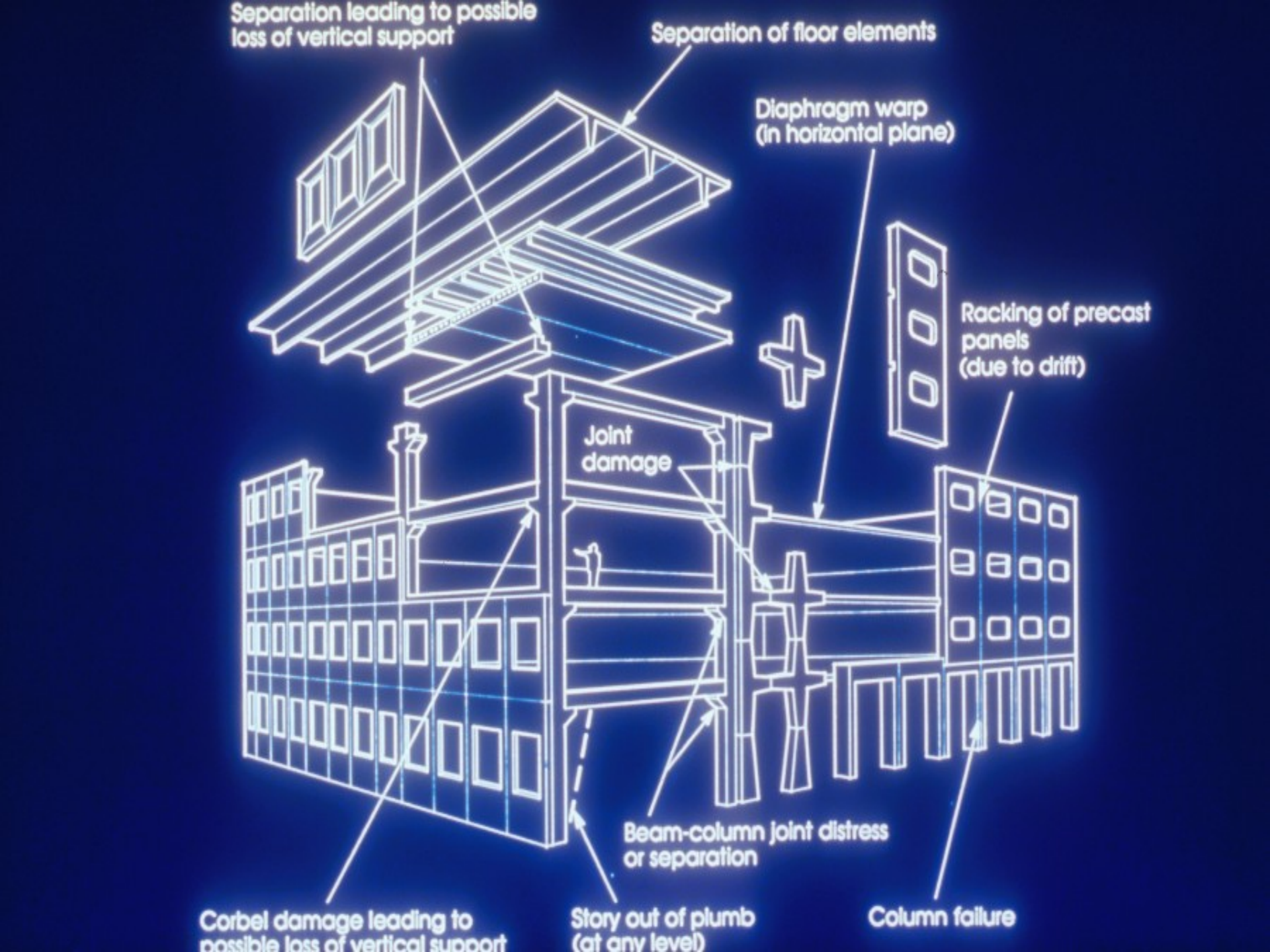
CONCRETE SHEARWALL BLDG C2

Roof/floor span systems:
1. heavy timber rafter roof
2. concrete joist and slab
3. concrete flat slab

Wall system:
4. interior and exterior concrete bearing walls
5. large window penetrations of school and hospital buildings



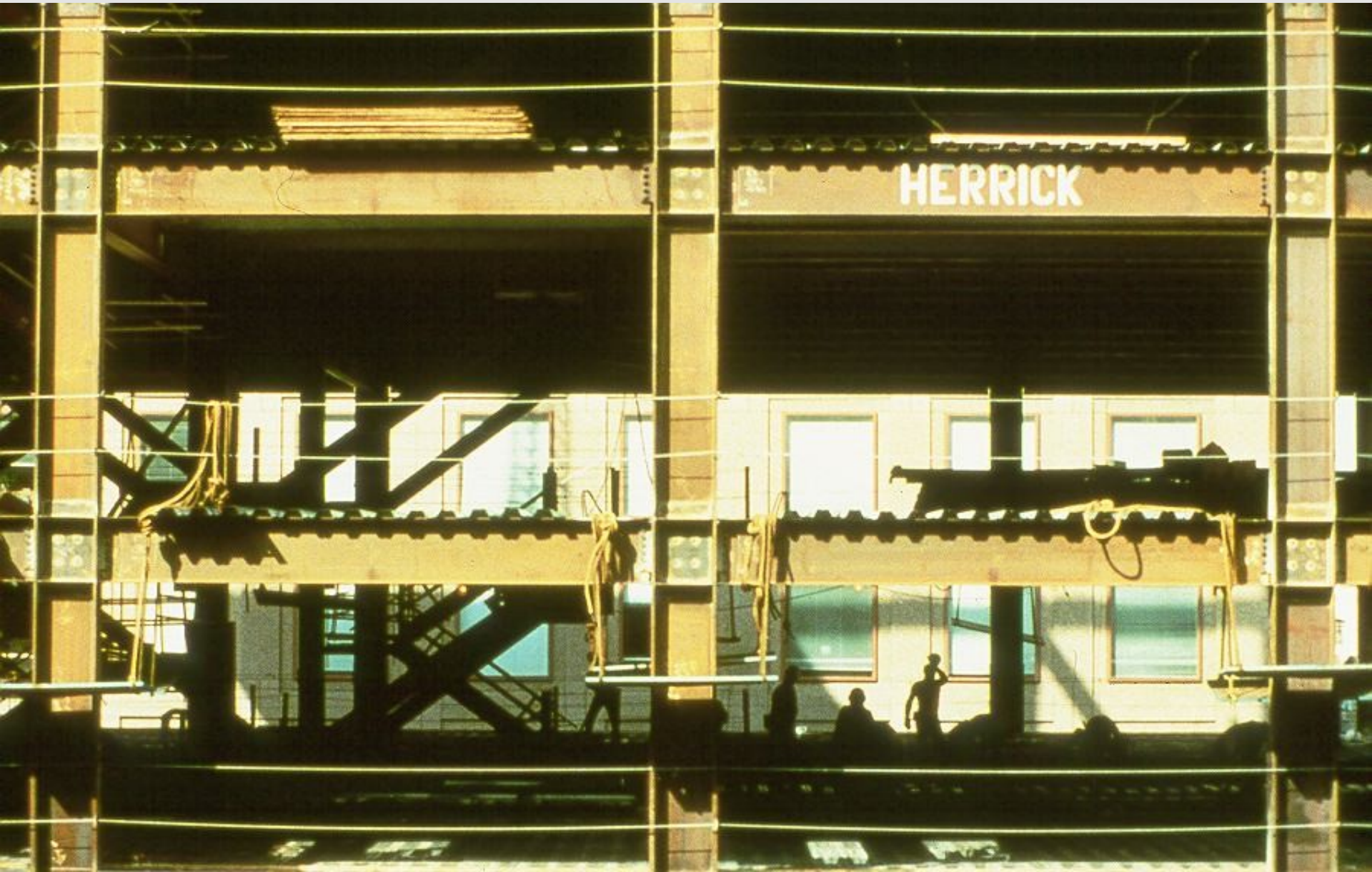

Roof or floor framing separation from wall
Diaphragm distress
Parapet damage
Falling hazards
Corner cracking at openings
Cracking of unreinforced masonry partitions
Shear failure of pier (at all levels)
Story out of plumb


Separation leading to possible loss of vertical support
Separation of floor elements
Diaphragm warp (in horizontal plane)
Racking of precast panels (due to drift)
Joint damage
Beam-column joint distress or separation
Corbel damage leading to possible loss of vertical support
Story out of plumb (at any level)
Column failure

STEEL FRAME CONSTRUCTION

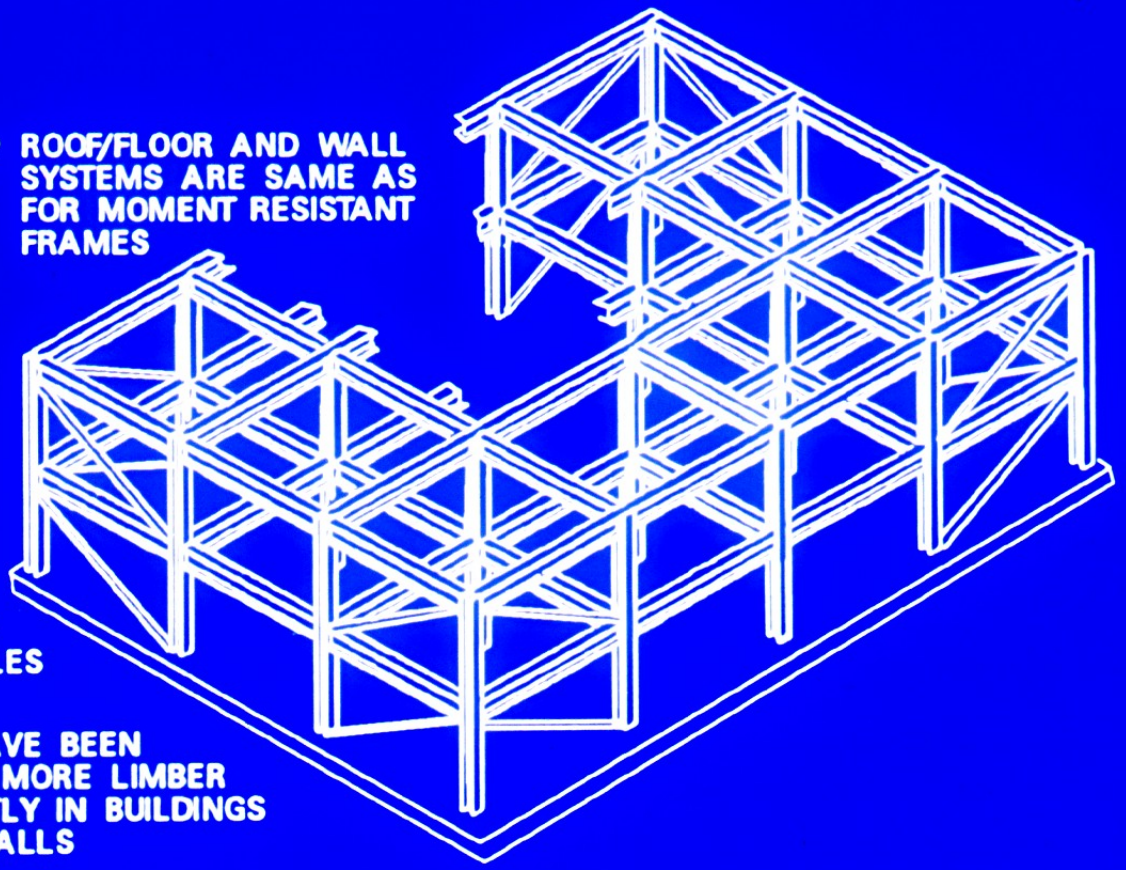
- Chapter 9, ATC 20-1
- Multi-story fire resistive frame
  - Fireproofing presents inspection problems
- Pre-engineered Light Steel Frame

Steel Moment Frame



STEEL FRAME BUILDINGS S2

- ROOF/FLOOR AND WALL SYSTEMS ARE SAME AS FOR MOMENT RESISTANT FRAMES

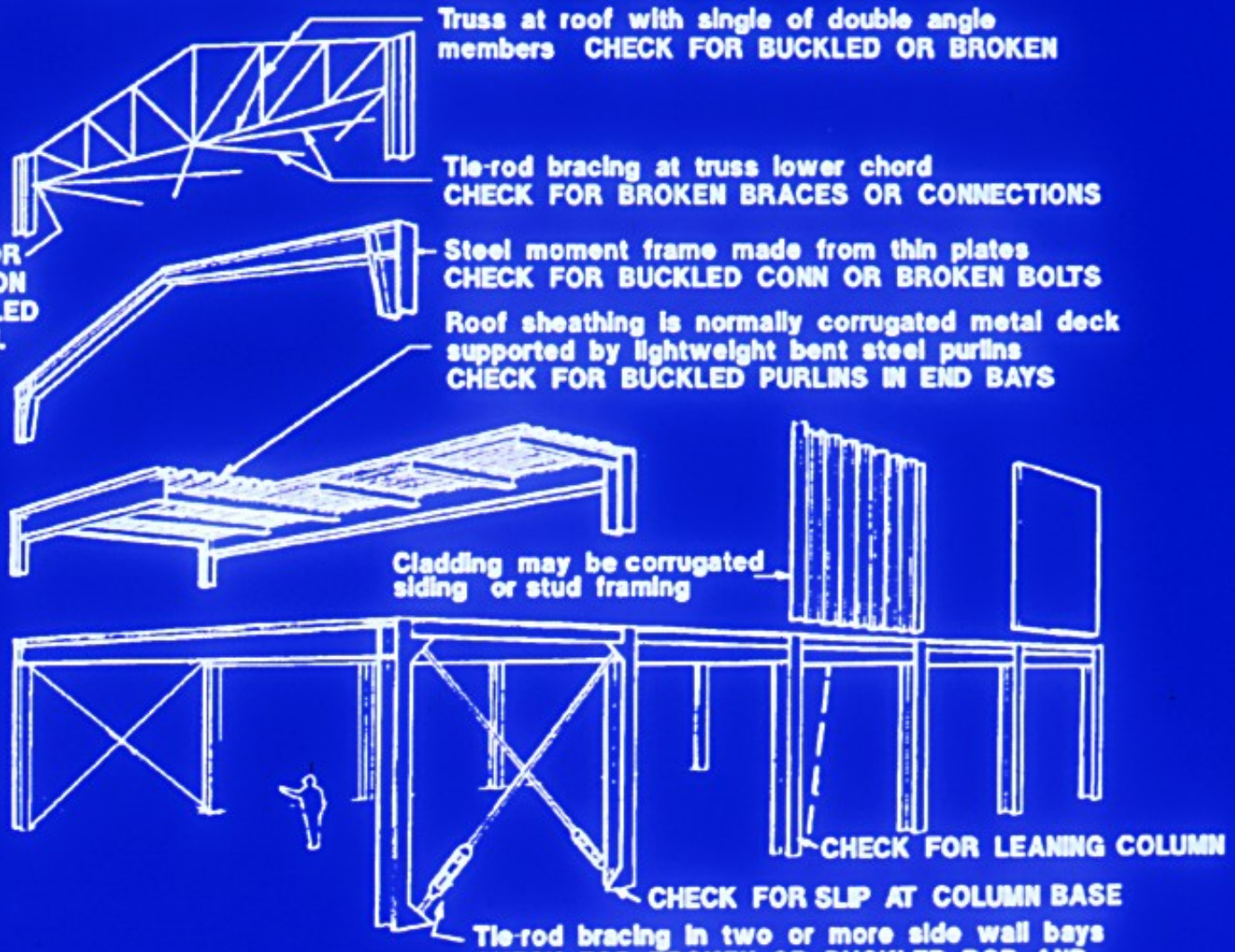


- BEAMS AND COLUMNS WILL BE SMALLER THAN FOR MOMENT RESISTANT FRAMES OF SAME LAYOUT

- DIAGONAL BRACES MAY BE STEEL TUBES, DOUBLE ANGLES OR W BEAM SECTIONS.
- X BRACING USING RODS HAVE BEEN USED BUT SINCE THEY ARE MORE LIMBER THEY ARE NOW USED MOSTLY IN BUILDINGS WITH INDUSTRIAL METAL WALLS

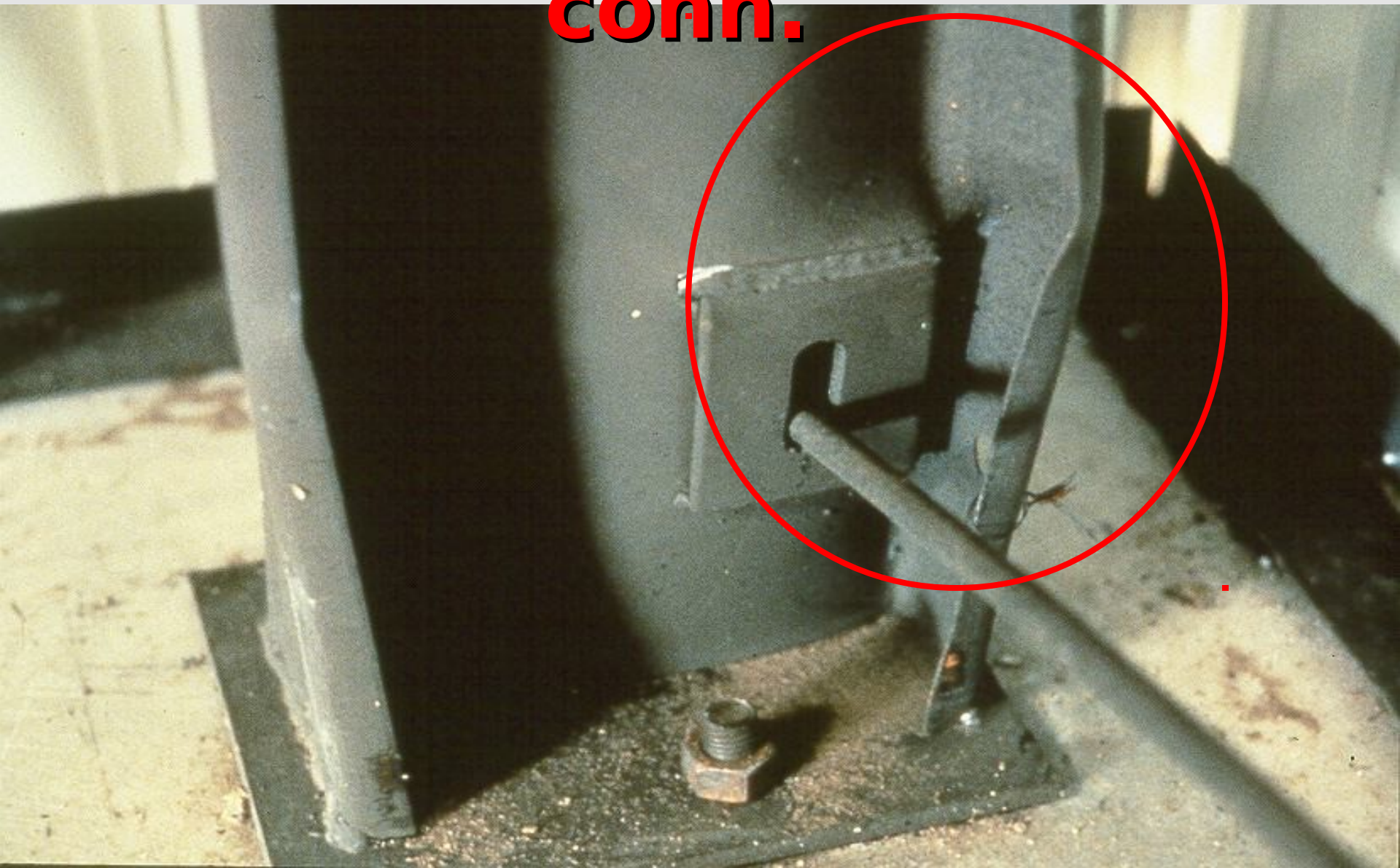
EUREKABANK

LIGHT METAL BUILDINGS S3


Truss at roof with single of double angle members CHECK FOR BUCKLED OR BROKEN
Tie-rod bracing at truss lower chord
CHECK FOR BROKEN BRACES OR CONNECTIONS
CHECK FOR SEPARATION OR BUCKLED END CONN.
Steel moment frame made from thin plates
CHECK FOR BUCKLED CONN OR BROKEN BOLTS
Roof sheathing is normally corrugated metal deck supported by lightweight bent steel purlins
CHECK FOR BUCKLED PURLINS IN END BAYS
Cladding may be corrugated siding or stud framing
CHECK FOR LEANING COLUMN
CHECK FOR SLIP AT COLUMN BASE
Tie-rod bracing in two or more side wall bays
CHECK FOR BROKEN OR BUCKLED ROD AND BROKEN CONNECTIONS

NAVY
NAVY

Light Steel Frame
Common damage at rod conn.



WINDSTORM DAMAGE PATTERNS BF-31

1. WINDSTORMS OFTEN PRODUCE FLOODING

2. MOST DAMAGE/COLLAPSE IS TO LIGHT, POORLY OR NON-ENGINEERED STRUCTURES - NOT ALWAYS

3. HIGH WINDS LOAD & PEEL OFF LIGHT WALLS/ ROOF OF STRUCTURES - ESPECIALLY OPEN STRUCTURES

4. AIRBORNE MISSILES PENETRATE STRUCTURE - CAUSE COLLAPSE BY IMPACT OR BY CREATING OPEN STRUCTURE

5. TIDAL SURGE/HIGH WAVES CAN CAUSE COLLAPSE/DAMAGE TO ENGINEERED STRUCTURES

PROBLEMATIC BUILDING TYPES BF-32

1. WOOD HOUSES
2. MOBILE HOMES
3. WOOD FRAME - MULTI-RESIDENCE & COMMERCIAL
4. LIGHT METAL BUILDINGS
5. COMMERCIAL/INDUSTRIAL - WALLS OF URM, RM, TU
   (WHEN LARGE OPENINGS ARE PENETRATED)
6. LONG SPAN STRUCTURES - HIGH WALLS - HANGERS

COMMON WINDSTORM COLLAPSE BF-33

- ROOF BLOWS OFF & WALLS COLLAPSE DUE TO LACK OF LATERAL SUPPORT
- THIN/WEAK WALLS BLOW OUT CAUSING ROOF COLLAPSE
- LIGHT METAL BLDGS COLLAPSE DUE TO BUCKLING OR BENDING FAILURE OF LONG SPAN ROOF, OR PULL OUT OF FRAME BASE " *WEAK LINK BEHAVIOR* "
- MISSILE PENETRATES GLAZED OPENING OR DOOR BLOWS IN, STRUCTURE CHANGES FROM "*CLOSED*" TO "*OPEN*", ROOF AND/OR WALLS BLOW OUT - *EVEN CONCRETE*

NONSTRUCTURAL HAZARDS

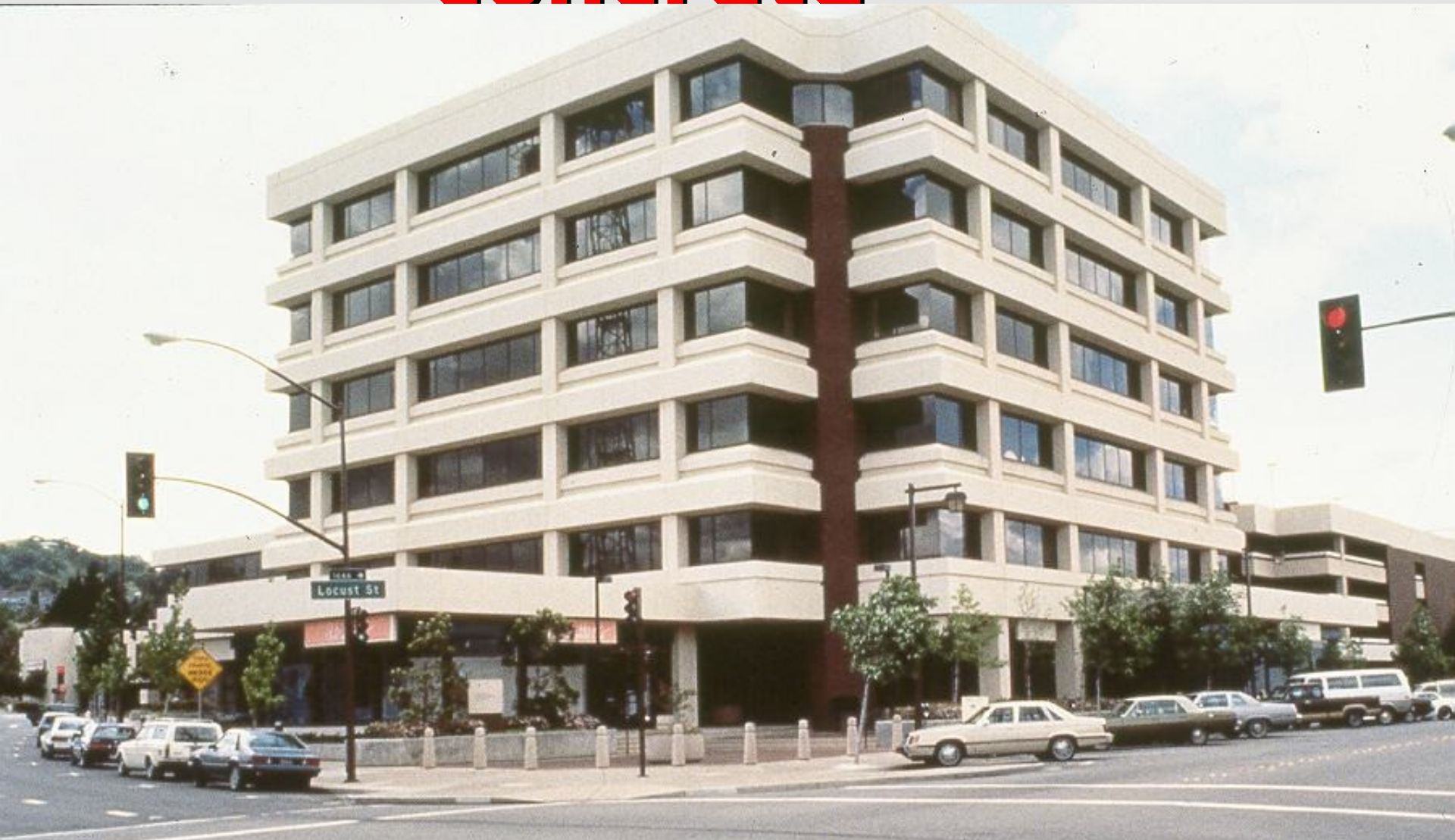
- Chapter 11, ATC 20-1
- Parapets, chimneys, ornamentation
- Cladding and glazing
- Partitions
- Suspended ceilings, raised floors
- Piping and Ductwork
- Equipment and furnishing
- Portable buildings

Masonry Parapets common problems

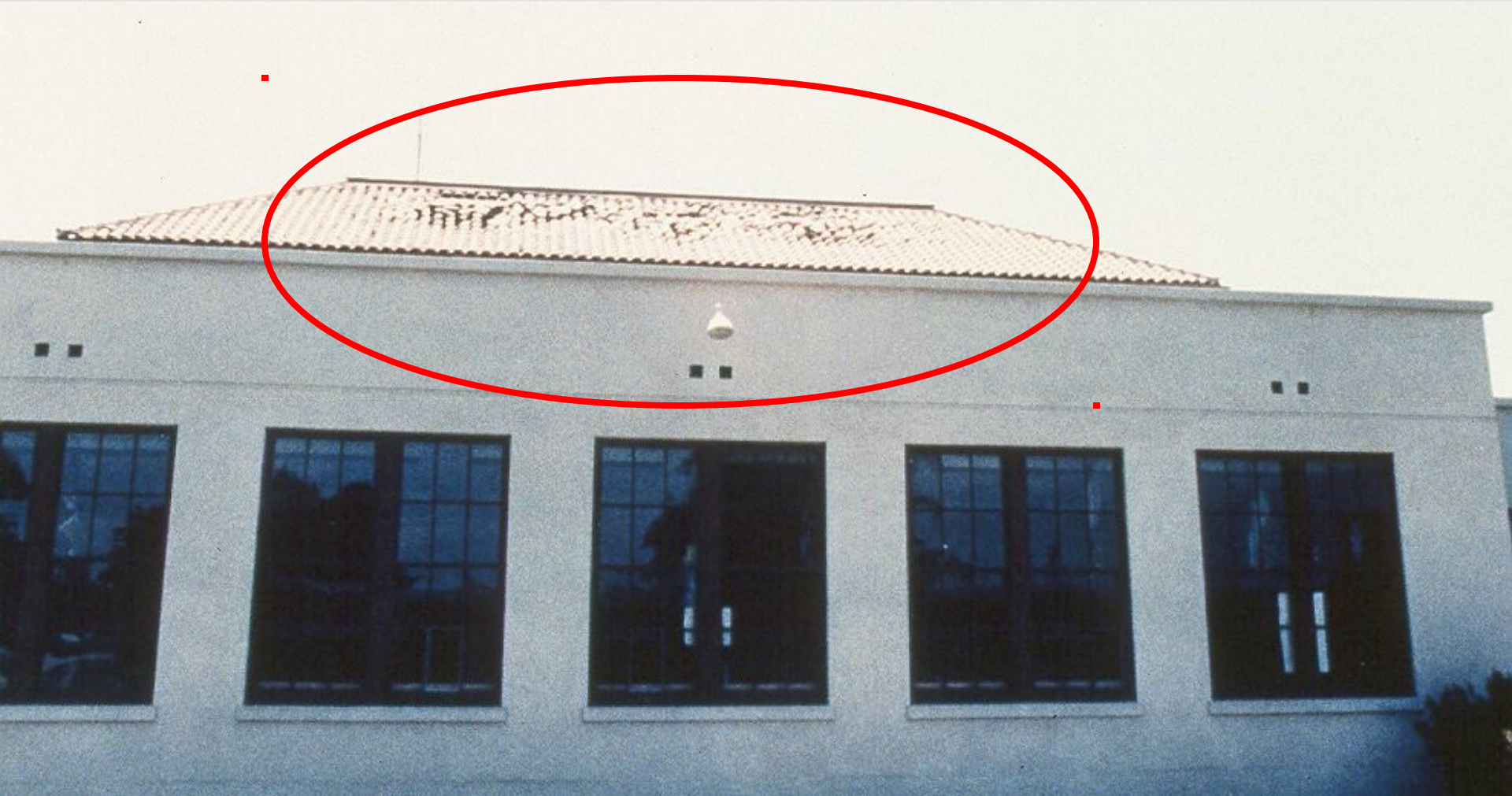
Same parapet from rooftop

Falling hazard

Curtain wall hazards especially precast concrete

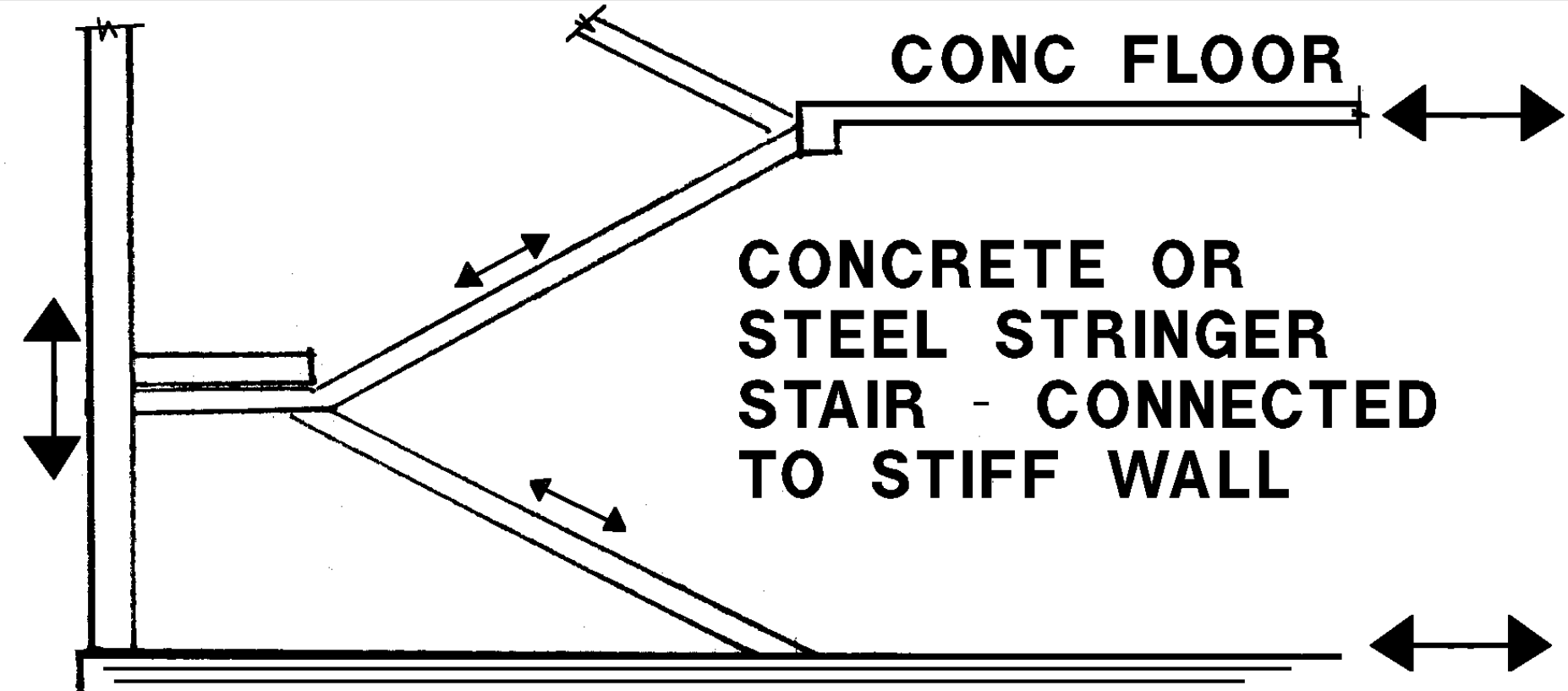


Roofing
especially heavy tile



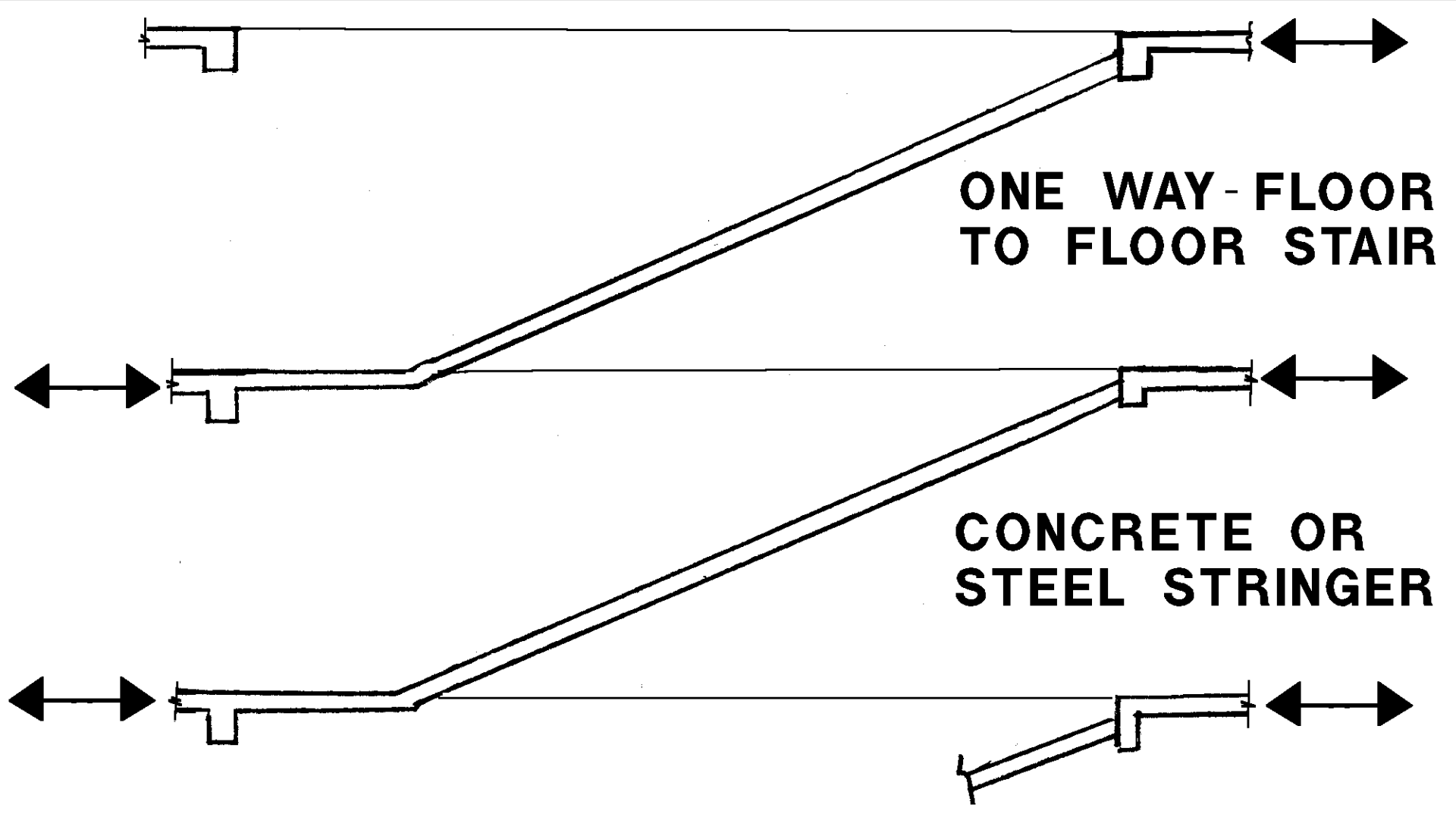
DAMAGE TO INTERIOR STAIRS

- Stairs act as unplanned diagonal bracing
- If stairs are relatively stiff, they can be damaged significantly
- May not effect overall building response, but may cause limited access



DAMAGE TO INTERIOR STAIRS

- Either Concrete or Steel Stairs may be a problem

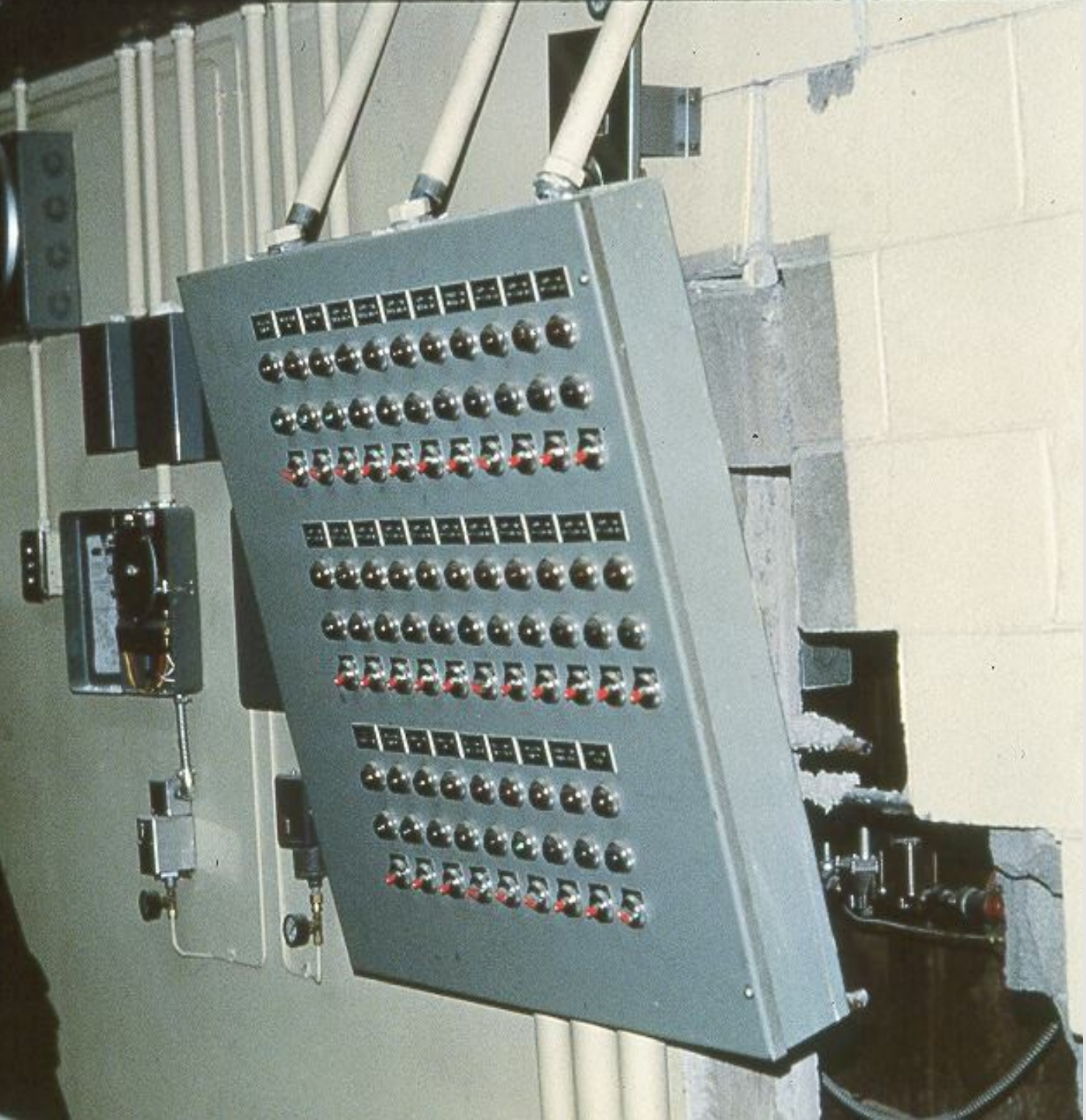


Stairs

Unplanned bracing

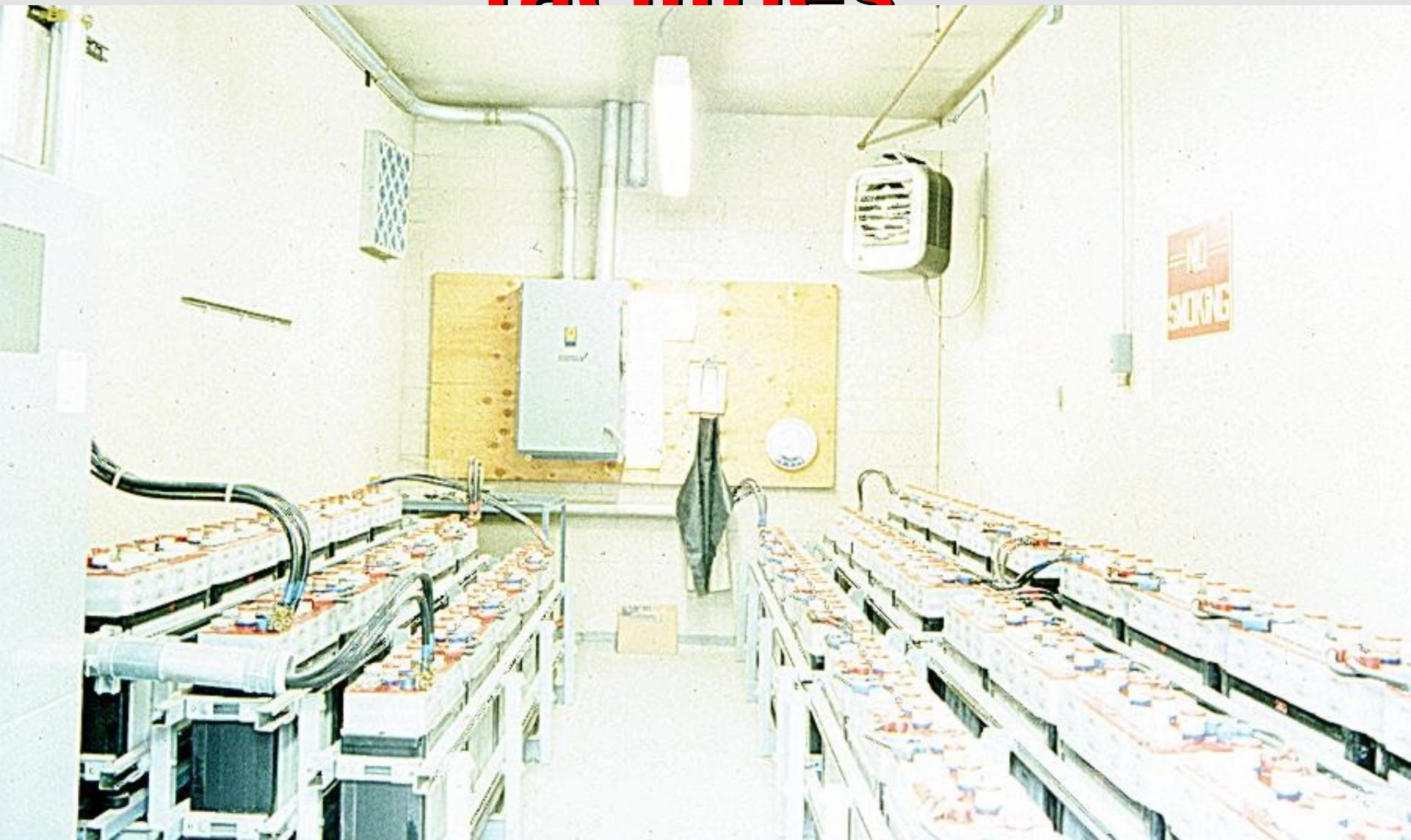
Damaged ceiling

Damaged strip lighting



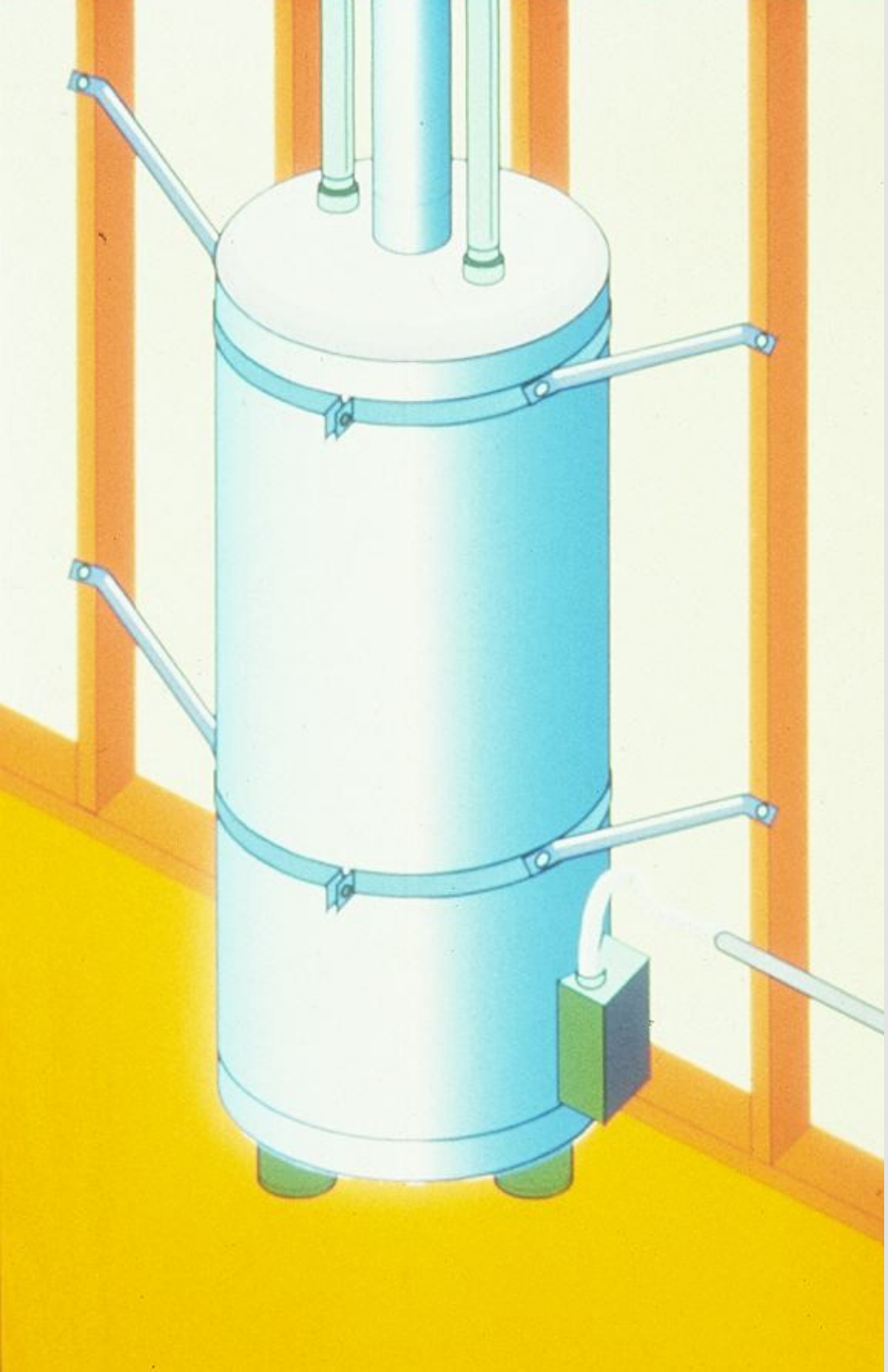
Damage to Electric Panel

Battery Racks often used in essential facilities



Damaged battery racks

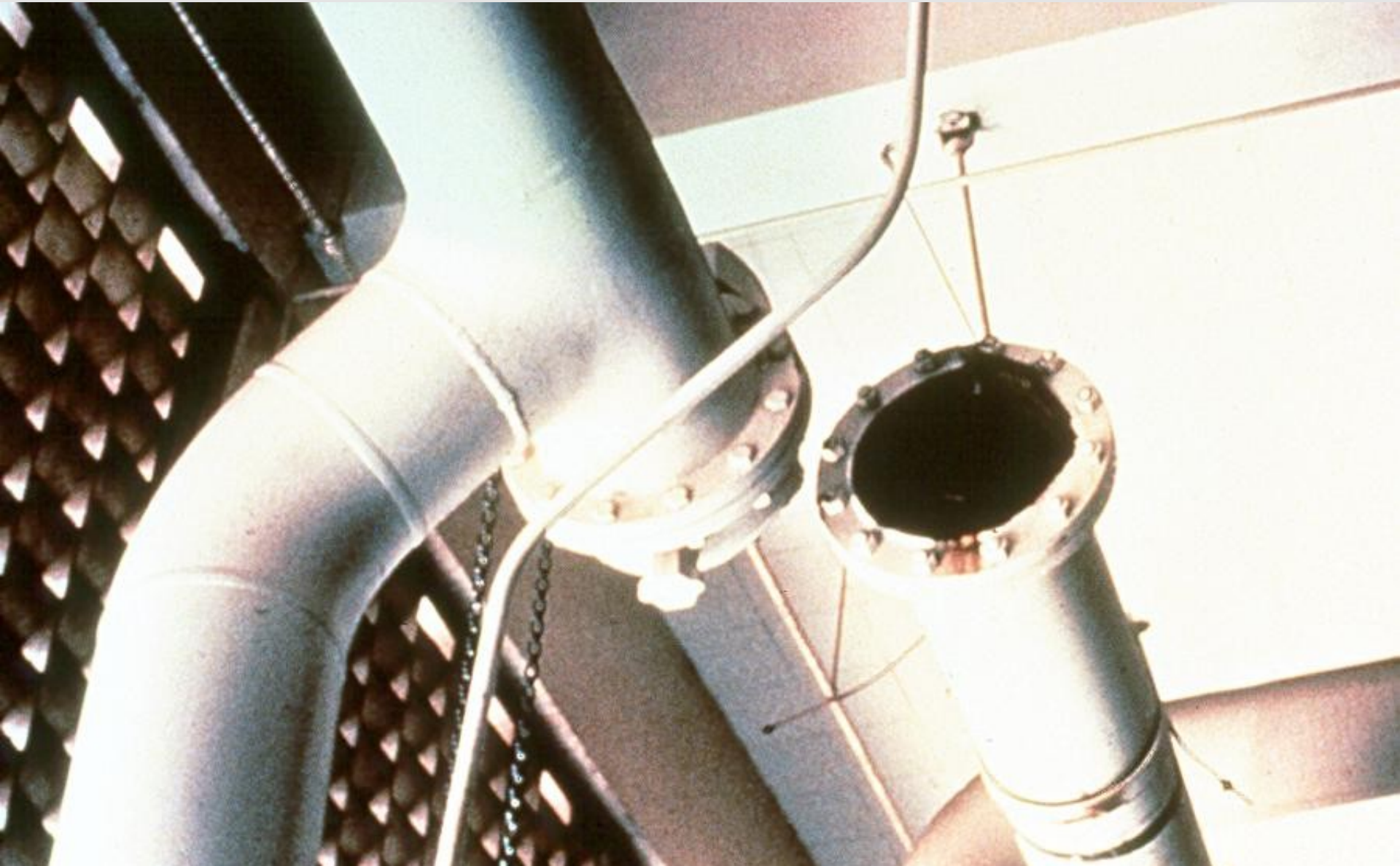
Toxic & messy



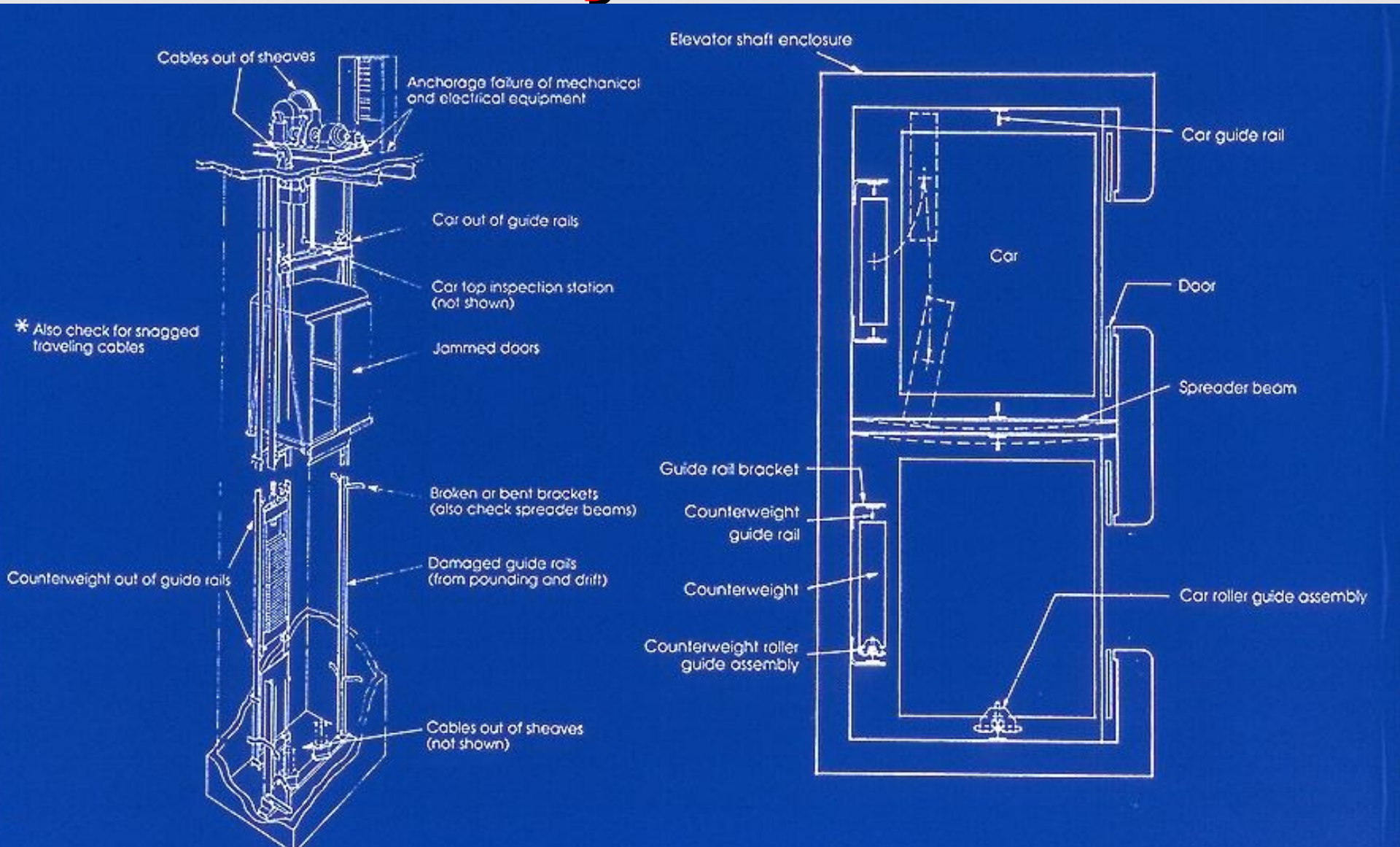
Check Connections, Vents, & Pipes

Boilers not tied down can slide

Broken pipes



Have Elevator guides checked by Elevator Co


Cables out of sheaves
Anchorage failure of mechanical and electrical equipment
Car out of guide rails
Car top inspection station (not shown)
* Also check for snagged traveling cables
Jammed doors
Broken or bent brackets (also check spreader beams)
Damaged guide rails (from pounding and drift)
Counterweight out of guide rails
Cables out of sheaves (not shown)
Elevator shaft enclosure
Car guide rail
Car
Door
Spreader beam
Guide rail bracket
Counterweight guide rail
Counterweight
Counterweight roller guide assembly
Car roller guide assembly

Bookshelves are common problem

tip over or throw books

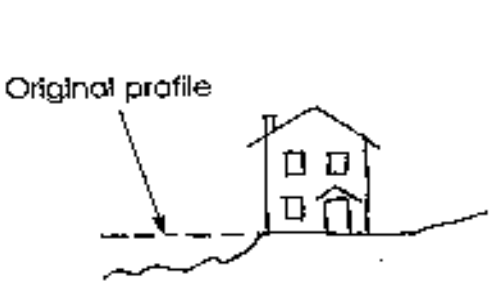
Poorly anchored Mobile Homes can collapse

Typical Racked Mobile Home

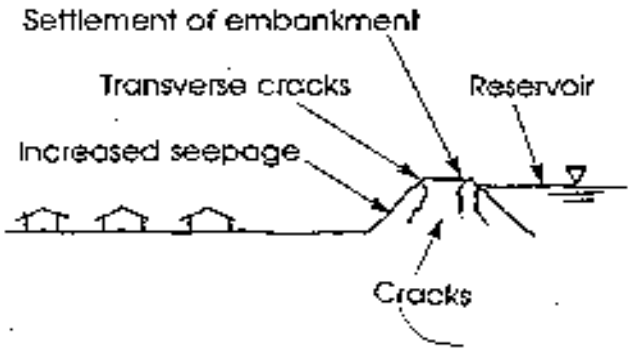
GEOLOGIC HAZARDS

- Chapter 10, ATC 20-1
- Cause increased shaking
- Landslide
- Liquefaction
- Subsidance
- Lateral spreading

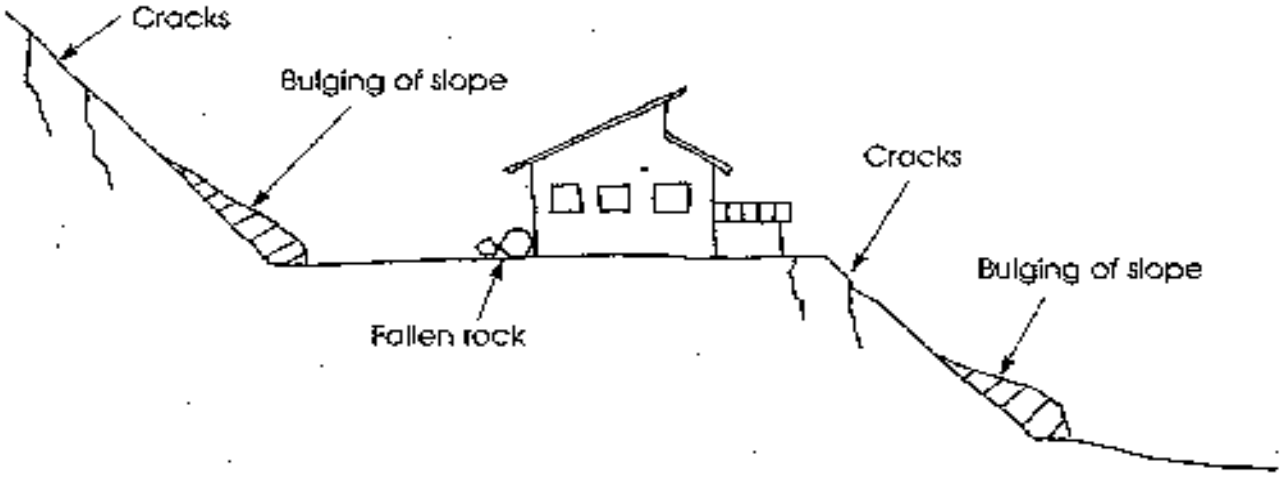
POTENIAL SLOPE FAILURES



Loss of Foundation Support



Unsafe Area



Potential Slope Failures

Classic Liquefaction

Anchorage, AK 1964

Figure 11.5 Whenever large slides appear to threaten the safety of buildings, geotechnical specialists should assess the possibility of further movement.

Anchorage, AK 1964

Anchorage, AK 1964

Damaged Hwy Bridges should be anticipated

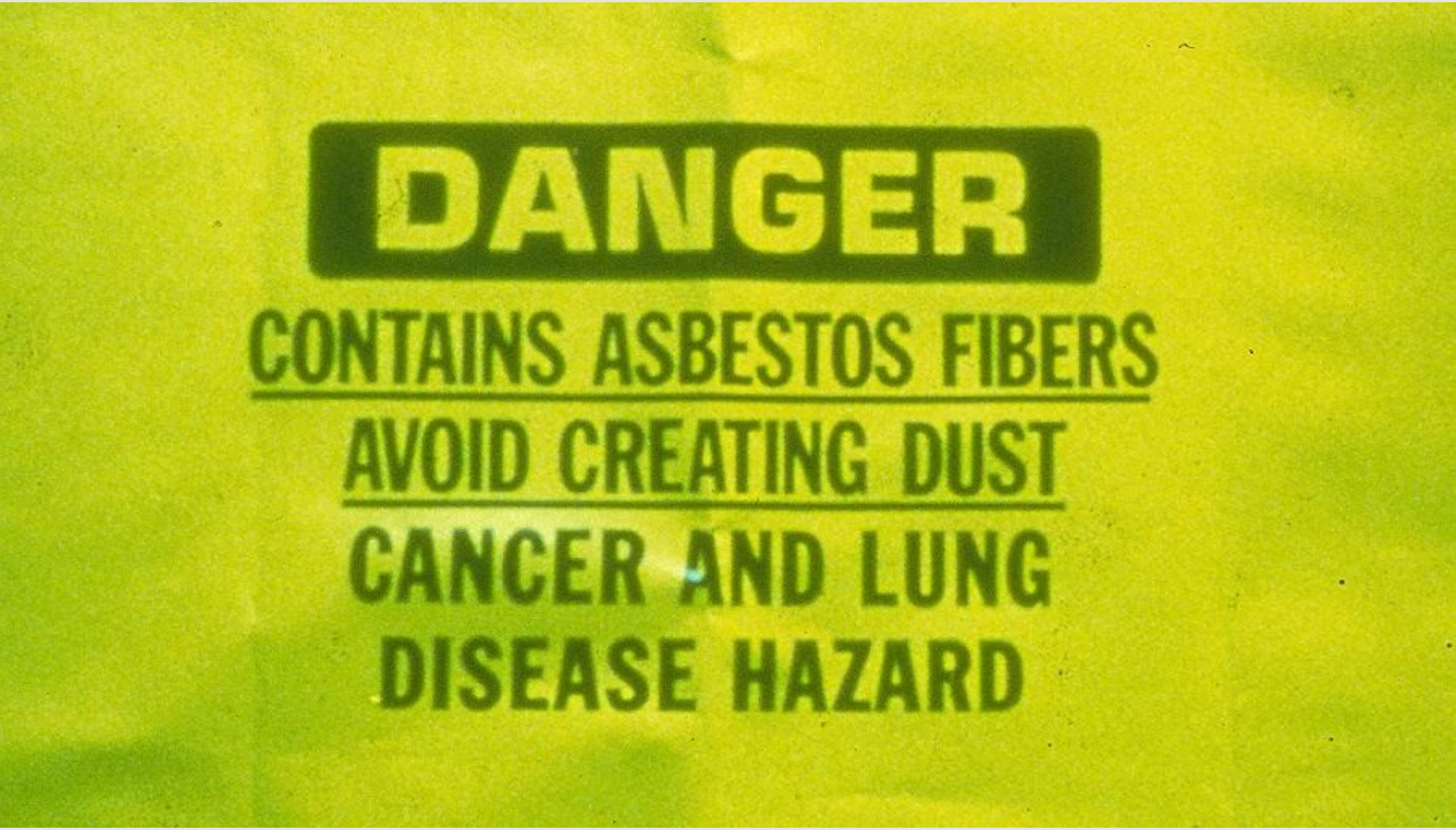
HAZARDOUS MATERIALS

- Recognize and Refer
- Recognize
  - Type of Facility
  - Clues (leaking containers, I.D. placards)
- Refer
  - Seal off, Barricade, Post Area
  - Notify EFO
  - Leave Area

Chem Lab - Obvious danger

Grocery - not so much danger

Asbestos Warning



Asbestos Hazard

Is it Friable ?

U.S. Dept of Transportation Std for Labeling Containers

FIELD SAFETY

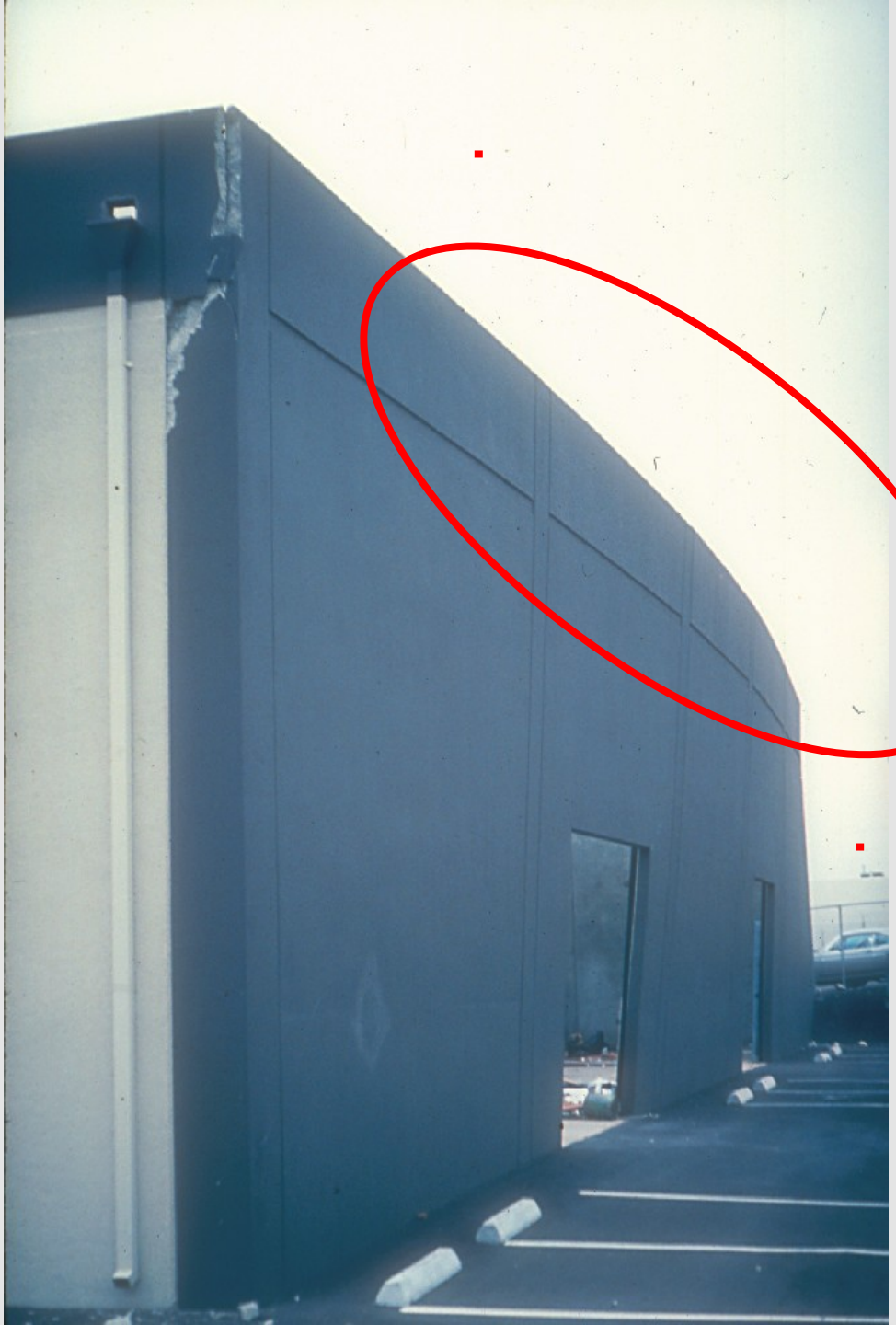
- Appendix C, ATC 20-1
- Travel in teams of two
- Wear a hard hat
- Survey building exterior before entering
- Enter only if safe
  - Only one at a time
- Avoid Hazardous Materials

FIELD SAFETY

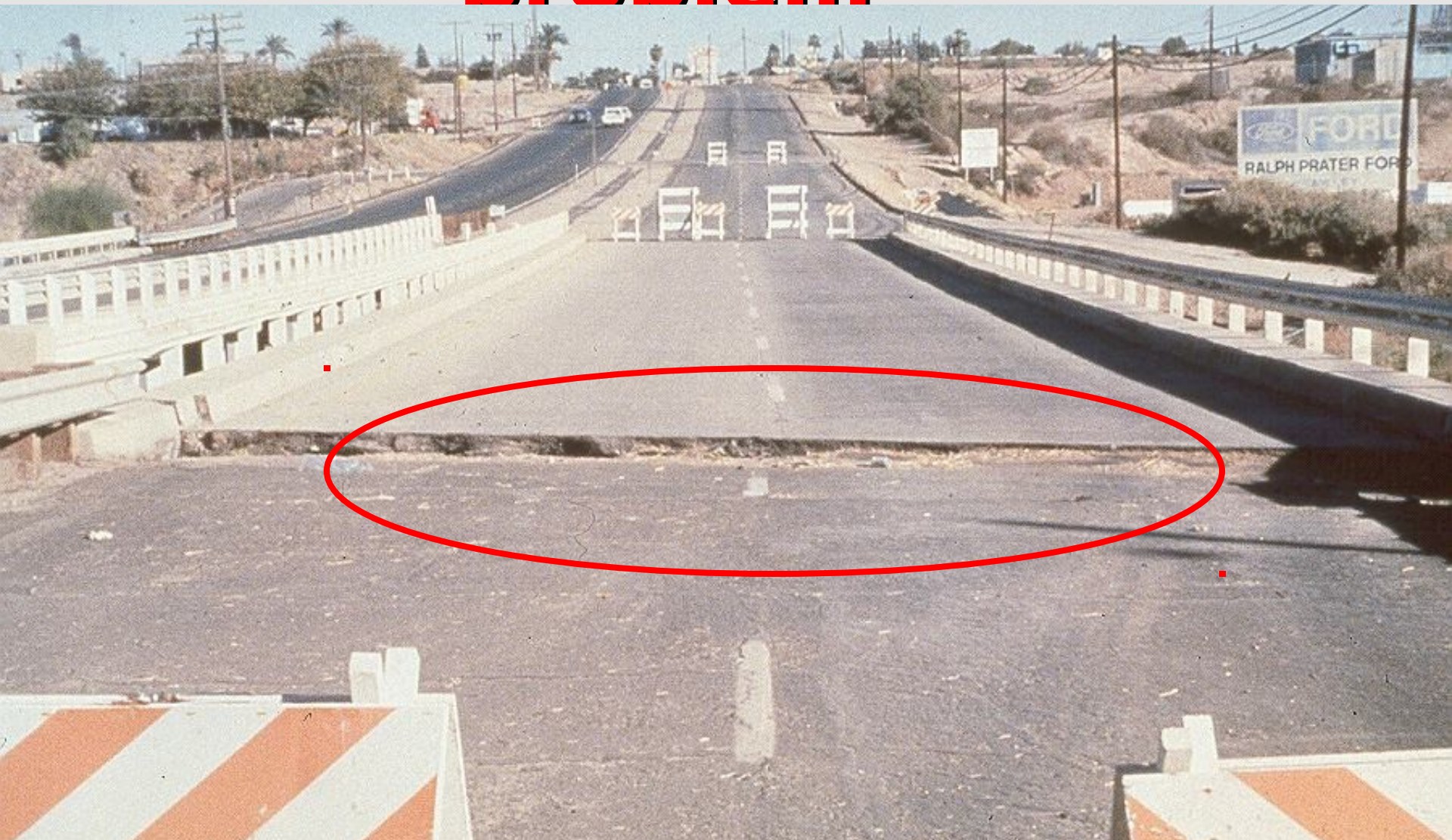
- Appendix C, ATC 20-1
- Use safety equipment
- Be alert for Falling Hazards
  - It’s really easy to get distracted
- Beware of downed Power Lines
- Look for and Report Gas Leaks
- In case of Fire, evacuate and alert Fire Department

PARKING

PEOPLE



Bridge abutment subsidence - common problem

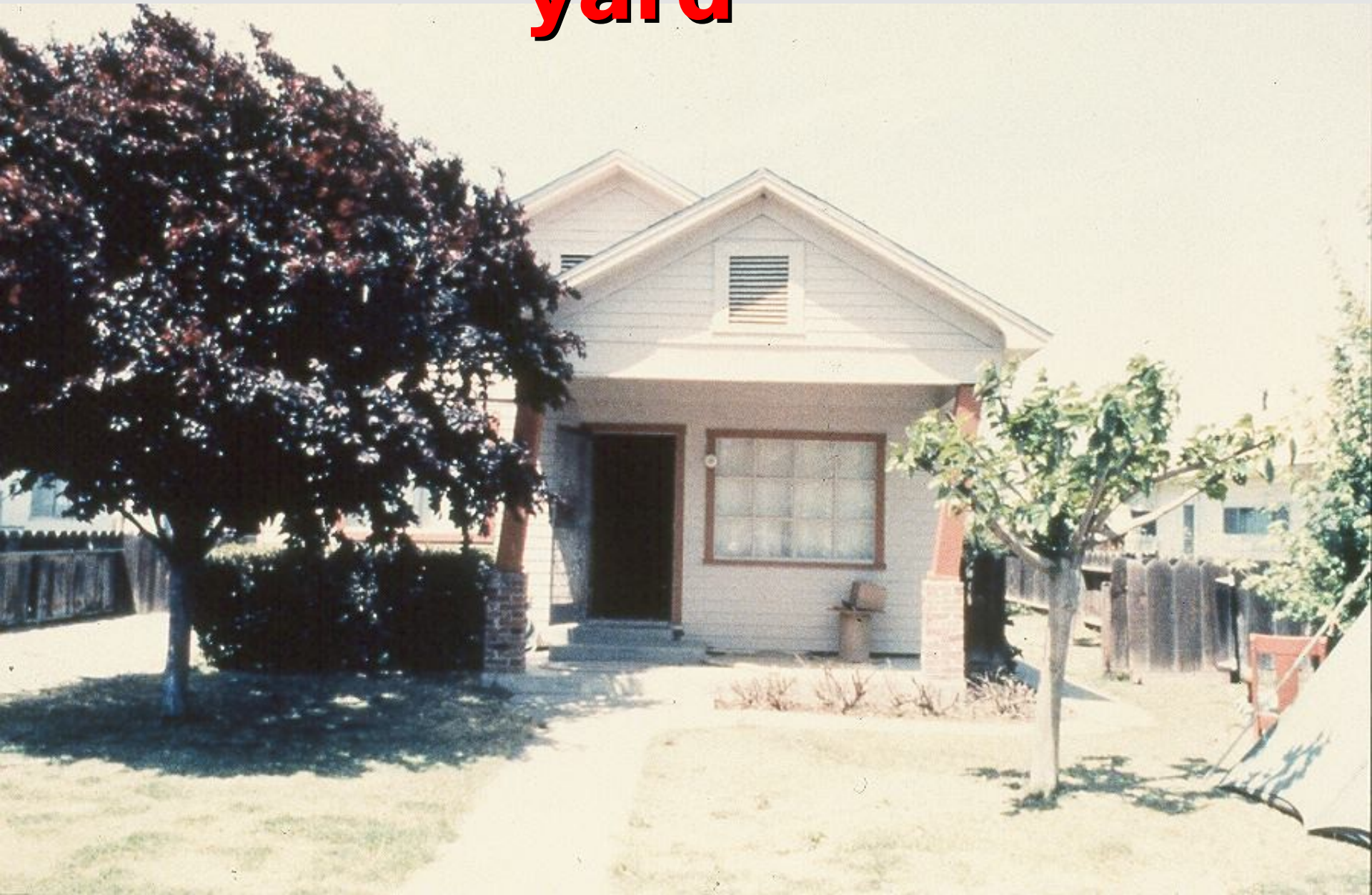


HUMAN FACTORS

- Appendix B, ATC 20-1
- This is a PEOPLE business!!

This is *People Business*, you may need to stop & reassure

Camping out in front yard



SUMMARY – PART II

- Introduction to ATC Documents
- Posting System
- Evaluation Process
- Structure Types
- Non Structural Elements
- Geotechnical Hazards
- Hazmat & Safety
- Human Factors

SUMMARY – CON'T

- Disasters attract the attention of public, press, & television
- DO NOT answer questions from them
- Politely refer all questions to the PAO at the ERRO and continue duties

COMPLETE MISSION AS

TIMELY AND SAFELY AS

POSSIBLE!!!!!